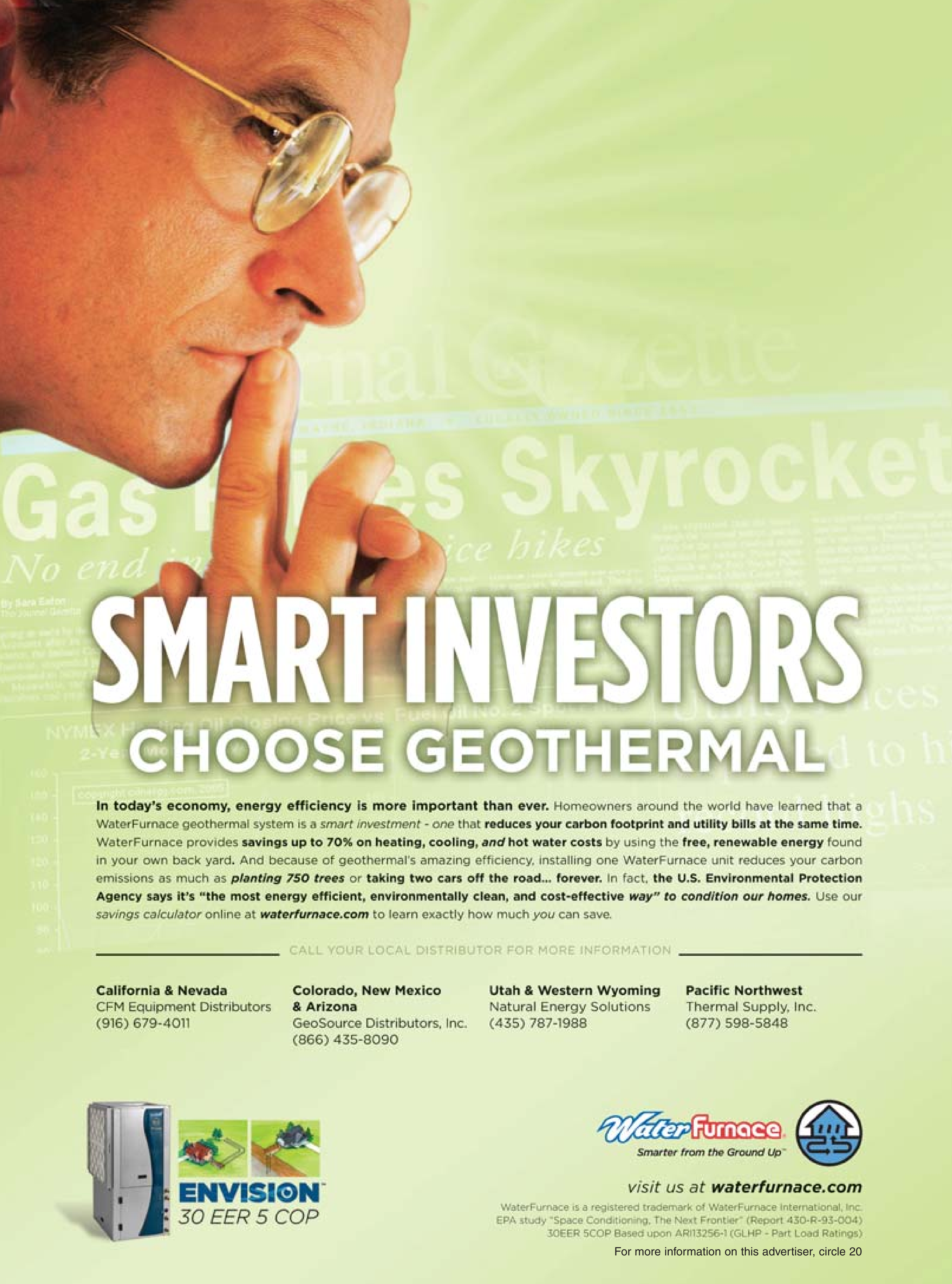
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September/October 2007

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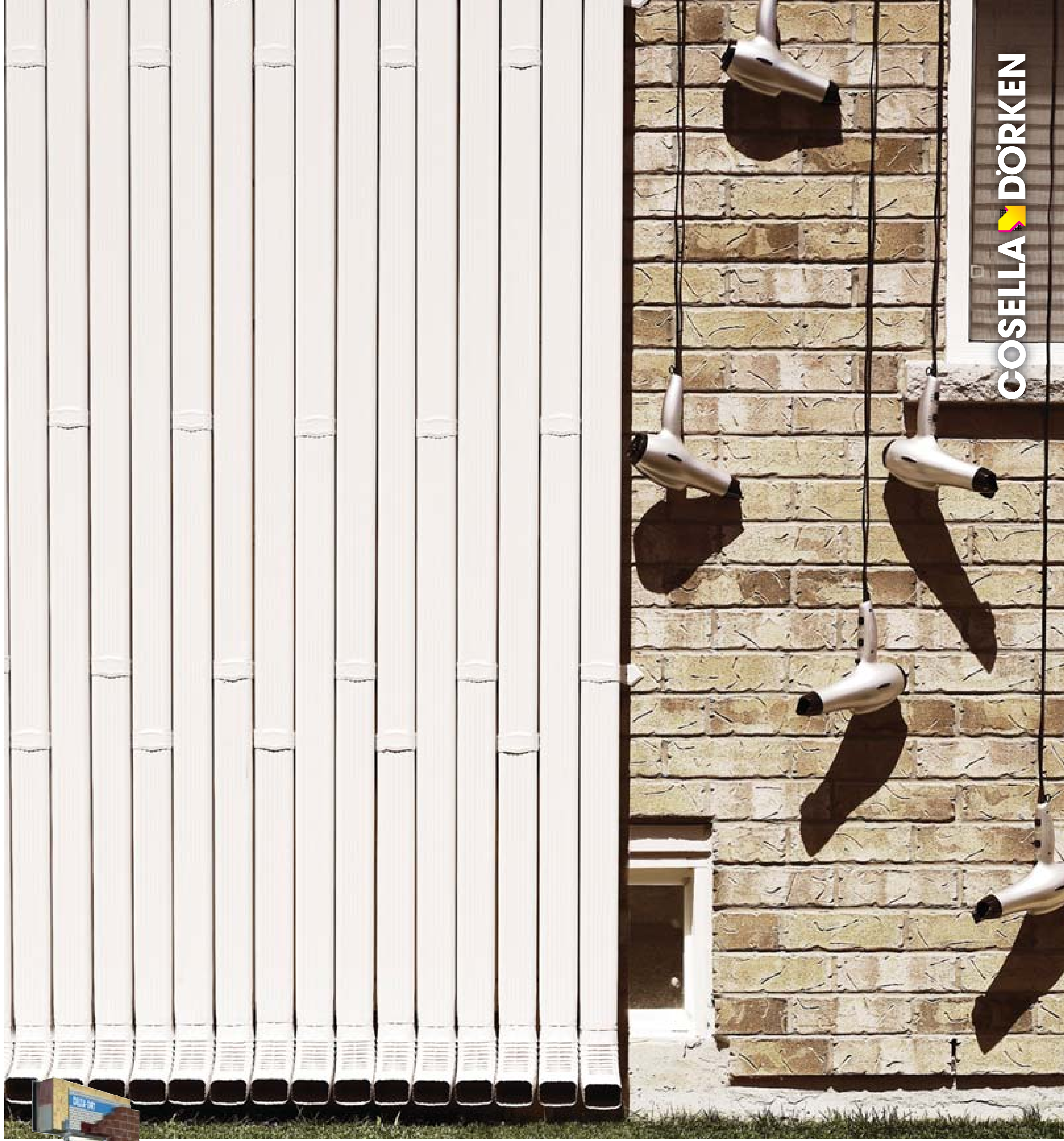

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September/October 2007

MISSION STATEMENT

The mission of *Ultimate Home Design* is to serve as a catalyst for homeowners to create demand for architects, designers, and builders to adopt the concepts and building practices that define human-centered, optimum-performance home design. *Ultimate Home Design* is aimed at broadening the segment of the American population that is paying closer attention to the products they buy, looking beyond price and branding to focus on other elements of the production and value chain. Increasingly homeowners want to support sustainable building practices that result in a higher living standard. *Ultimate Home Design* is for those homeowners who want to promote a broader shift in patterns of production and consumption by encouraging practices that better reflect their personal values. We are advocates for using products that reduce energy and use renewable, recycled content or otherwise environmentally preferable materials. An important part of our mission is to promote building practices that result in a substantial reduction in energy use for space conditioning, water heating, lighting, and appliance operation. Another important aspect of our mission is to promote construction practices that improve the indoor environment and reduce the risk of building-related illness. This translates to improved occupant health and comfort by improving thermal comfort; natural lighting and electric illumination; and controlling humidity, odor, noise, and vibration.

Ultimate Home Design is for the thinking homeowner, who wants to be educated and learn about intelligent options for home design, whole-house system design, and comprehensive electronic lifestyle features that can enrich the quality of day-to-day life while reducing the cost of operating a home. With the knowledge gained reading *Ultimate Home Design*, you will be empowered to make intelligent choices about the design and make-up of your home, whether considering remodels or additions, planning a new home, or evaluating an already-built home. *Ultimate Home Design* will explore the wide range of possibilities within the context of designing Optimum Performance Homes™ that integrate universal design architecture; sustainable green building materials and techniques; energy-efficient power systems for electricity, lighting, heating, and air conditioning; water conservation techniques; and comprehensive electronic lifestyle features.

Editor-In-Chief & Publisher
Gary Reber

Executive Publisher
Marlene Reber

Editorial Directors:
Wolfgang Preiser, Ph.D.
Universal Design
Demian Martin
Electronic Lifestyles
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Electronic Home Healthcare
Bill Wilson
Environmental Design
Ann V. Edminster, M.Arch
LEED Design
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LEED Design
Julie Stewart-Pollack, ASID, IDEC
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Contributing Writers:
Betsy Cragon
Norman Ehrlich
Ingrid Ekstrom
Terence Parker
Christine Puleo
Ryan Stauffer

Staff:
Sarah Scaglione
Director Of Marketing/Products Editor
Nathanael Fowler
Art Director
Tricia Spears
Editor
Jack Kelley
Editor

Subscription/Production
Cynthia Nemelka, Subscriptions Manager
27645 Commerce Center Drive
Temecula, CA 92590 / 888 977 7827
Phone 951 676 4914 / Fax 951 693 2960
Subscriptions@UltimateHomeDesign.com

UHDPublications.com STORE
Contact: Cynthia Nemelka, Customer Service
subscriptions@UltimateHomeDesign.com

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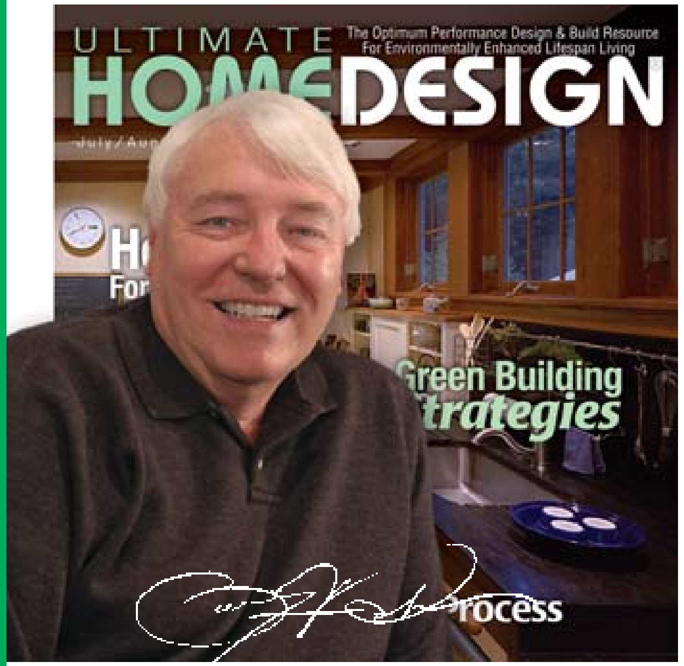

Solar, Wind, And Geothermal On-Site Energy Generation

In the last issue of *Ultimate Home Design*, I wrote about the various clean energy-generation technologies. In this issue we will focus on the feasibility of on-site solar, wind, and geothermal energy generation as an integral component of designing and building Optimum Performance Homes™.

Homeowner options for using on-site energy-generation technologies to reduce carbon emissions in the atmosphere, reduce crude oil dependency, and achieve a "Zero-Energy Cost" home operation are gaining significant traction as a way to green homes and reducing energy consumption.

Whether it is solar photovoltaics (PV) or wind power to generate electricity, or passive solar and geothermal systems to heat water, these renewable energy technologies save natural resources, reduce carbon emissions, and offer money-saving opportunities for homeowners.

For example, solar water heating was named one of the top ten technologies for 2007 by the Department of Housing and Urban Development's Partnership for the Advancing Technology in Housing (PATH) program. Solar water heating is experiencing a comeback after a nearly 20-year hiatus. Incentives in the form of new federal tax credits and the rising price of energy are driving this renaissance of interest. And solar water heating offers one of the more cost-effective ways to incorporate renewables into a home—as little as one-tenth the cost of photovoltaics and a more efficient use of the sun's energy. And the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy states that a solar water heating system reduces the need for conventional methods by two-thirds.

Three articles are featured in this issue describing different types of solar water heating systems. Passive systems are designed for warm or moderate climates and store heated water in an integrated tank or in the collector plate. Active systems using either/or both antifreeze fluid and water to collect heat are designed for colder climates.

As an architectural magazine that advocates responsible green building initiatives, with respect to on-site energy generation, we support the idea of a "feed-in tariff," giving anyone who generates power from solar, wind, or hydro a guaranteed payment from the local power company. Local power companies should be obliged to buy electricity generated by solar, wind, or hydro home installations. Germany-pioneered legislation, and other European countries—including Spain, Portugal, Greece, France, and Italy—are implementing similar legislation. At present, local power companies in the U.S. are not required to pay homeowners for the energy generated on-site beyond what the homeowners generate to produce a "Zero Energy Home" (ZED) cost operation. Thus, homeowners with systems designed to generate excess electricity are not compensated. "Feed-in tariff" legislation, which offers cash incentives, will become the most important means we have to boost the solar and wind energy market, and significantly reduce our country's dependence on foreign oil. Such legislation will make it lucrative for ordinary people to put solar systems on their roofs and wind turbines on their properties. The end result will produce a new class of homeowners who will be energy-independent and part of a network of clean energy producers.

In this issue, we feature several articles on PV solar power, hot-water solar power, wind power, and geothermal power. One of the articles is about a new wind turbine technology developed by Torrance, California-based PacWind (www.pacwind.net). PacWind has invented, engineered, and is in full production on a revolutionary line of vertical axis wind turbines (VAWTs) that are completely silent, stable, and safe in all wind conditions up to 100-plus miles per hour. They are affordable, maintenance-free, operate in all climate conditions, carry a ten-year manufacturer warranty, and are powered by the PacWind rare earth permanent magnet generator, which produces no pollution, making it a zero-emission generator. The VAWTs are also bird-, wildlife-, and people-friendly and well suited to residential applications. The small wind turbines are architecturally and aesthetically pleasing and can be disguised in wind-penetrating slatted towers to complement the architecture of any building and be attached to buildings, installed on rooftops, or mounted on standalone poles. They operate well in low-wind conditions, as low as seven miles per hour.

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Sarah Scaglione

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WaterFurnace, International, Inc. With energy costs and carbon emissions on the rise, homeowners are looking for more energy-efficient solutions that can save them money and protect the environment. WaterFurnace geothermal heating and cooling systems have answered this need by using the free energy found beneath the ground instead of fossil fuels to save homeowners up to 70 percent on their utility bills and reduce their carbon footprint. With added comfort, whisper-quiet operation, and improved indoor air quality a WaterFurnace geothermal system is a smart investment. For more information on this innovative energy solution, or to contact a local WaterFurnace Dealer, visit www.waterfurnace.com.

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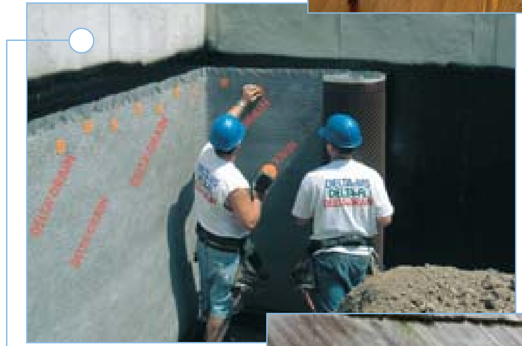

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Why Homeowners Worldwide Choose SunPower

Ingrid Ekstrom

Introduction

Approximately 25,000 homeowners in the United States rely on solar technology to power their homes, and that number is growing each year. Recent reports indicate that new homes equipped with solar electric power systems are selling about twice as fast as comparable non-solar homes in the same neighborhoods. Clearly, homeowners using solar power understand the environmental benefits of clean, renewable, noise-free solar power as well as the financial benefits, such as lower electric bills.

Homeowners who have chosen to install SunPower solar power systems on their homes are maximizing their solar investment by using the highest efficiency panels on the market. They are generating more power and using less roof space. They are also enjoying the aesthetic benefits of all-black solar panels, which blend into the roof design rather than contrasting against it as conventional panels do.

Since its founding in California in 1985, SunPower has been committed to developing industry-leading solar technology by providing:

- **Intelligent Engineering—More Power To You**

Unlike conventional solar cells, SunPower's innovative technology positions the electrical contacts at the back of the cell, leaving the entire front surface available to absorb and convert sunlight to power. This design results in a far more efficient solar cell. In fact, SunPower cells deliver up to 50 percent more power than conventional solar cells. In addition, they're proven to provide higher performance during the warmest seasons and maximize energy production in low-light conditions.

- **Elegant Design—Inside And Out**

Solar products should blend harmoniously into your environment, not stand out from it. It's a significant investment that should add, rather than detract, from the appearance of your home. To help achieve this, SunPower panels are uniformly smooth, dark, and free of metal grid lines that create unsightly reflective patterns.

- **Finest Quality Construction To Outlast And Outperform**

SunPower uses only premium materials in all of their products to ensure years of maintenance-free high-quality performance. By utilizing advanced technology and adhering to the most stringent safety requirements for high-voltage operation, SunPower solar cells, solar panels, and inverters are built to last. High-efficiency inverters further enhance the performance advantage of SunPower solar electric systems and come with an unmatched ten-year standard equipment warranty on the entire solar system.

SunPower Reduces Homeowners' Utility Bills By Eighty-Three Percent

With utility bills of $400 per month at their Los Gatos, California home, Sueling Cho and Tom Hammer were very motivated to find a better way. They had been talking about installing a solar power solution for years, but their steadily increasing utility bills—and the $400 peak they achieved in 2005—finally convinced them to act.

"Our winter utility bill was usually in the $200 to $300 range," recalls Cho. "But as energy prices continued to go up and our bill topped $400, I knew it was time to make a change. I was really worried about what we'd be paying when summer came and it was time to run the air conditioning." Cho did her research and concluded that a SunPower solar power system was the way to go. The evidence made her choice an easy one. "Through my research, I found an informational chart on the California Energy Commission's Web site that compared all of the most popular solar power vendors and their products. Quite clearly, SunPower was rated the most efficient. That really impressed me, because it meant that their panels wouldn't take up as much of my roof space. This concept was very attractive."

Cho contacted REgrid Power, a local SunPower Premier Dealer, to design and install a new solar array.

REgrid Power was first challenged by the fact that the 2,900-square-foot, two-story home's roof was partially shaded by a neighbor's redwood trees. Due to a variety of factors, removal of the tree or tree limbs was not an option. REgrid Power developed an innovative solution that resulted in the installation of 24 SunPower solar panels on both the first- and second-floor roofs. This solution enabled maximum sun exposure while leveraging the superior aesthetics of SunPower's uniquely all-black solar panels.

> SunPower 205 and 215 solar panels are designed specifically for use in residential grid-connected applications, where a combination of outstanding appearance and "high-panel" efficiency is required.

Sunset Magazine SunPower Installation

"One day, my next-door neighbor was working on his roof, and he actually said to me, 'Oh, did you get solar?' We'd already had the panels for a few weeks, and no one even noticed," said Cho. "SunPower's panels have a very slim, innovative design, so you almost can't see them."

Even more satisfying, Cho and Hammer's utility bills dropped from $350 to $400 a month to about $6.00. "I love having a $5.80 electrical bill every month!," exclaimed Cho. She expects the savings to pay off the cost of the solar system in 10 years.

Additionally, over the 30-year life of the 5-kilowatt (kW) system, Cho and Hammer will reduce carbon dioxide emissions by 118,299 pounds, which is equivalent to planting 30 acres of trees.

More Solar Power In Less Space

Like Cho, homeowners who choose SunPower are very pleased with the panels' uniformly black appearance, which blends into the roof design. Utilizing the highest efficiency solar cells commercially available, SunPower residential solar panels also provide up to 50 percent more power per unit area than conventional solar panels. This means more solar

power is generated using less space.

SunPower 205 and 215 solar panels are designed specifically for use in residential grid-connected applications, where a combination of outstanding appearance and "high-panel" efficiency is required. The unique all-black design gives them an exceptionally uniform appearance that integrates well into the roofline of any home. They feature SunPower A-300 solar cells, delivering a very high-power density and power ratings of 205 and 215 watts, respectively.

SunPower Premier Dealer Program

Earlier this year, SunPower launched its Premier Dealer program, the first nationwide program to support a network of solar power system dealers that sell, install, and service SunPower products. SunPower currently works with more than 100 dealers across the U.S.

Dealers selected to participate in the SunPower Premier Dealer program have agreed to provide customers with superior levels of service, including expedited turnaround on customer inquiries and participation in a post-installation site inspection program. SunPower Premier Dealers also complete regular training in the specification and installation of SunPower products.

"The SunPower Premier Dealer program is unprecedented in this industry," said Randy Kauffmann, Chief Executive Officer and founder of NextEnergy in Concord, California, a SunPower Premier Dealer. "For us, it means that we will be better prepared to serve our customers, answer their questions, and help them easily take that next step to reduce their utility bills and generate their own clean, renewable energy. It's a win-win situation all around."

"I'm happy that our dealers share our enthusiasm for the Premier Dealer program," said Tom Werner, Chief Executive Officer of SunPower. "Together, SunPower and SunPower Premier Dealers are raising the bar in the solar industry with higher-value products and services."

SunPower Premier Dealers conduct free in-home evaluations to determine homeowners' systems needs. Locating a SunPower Premier Dealer is as easy as phoning 877 786 0123 or visiting sunpowercorp.com. UHD

The Author

Ingrid Ekstrom manages communications for SunPower Corporation.

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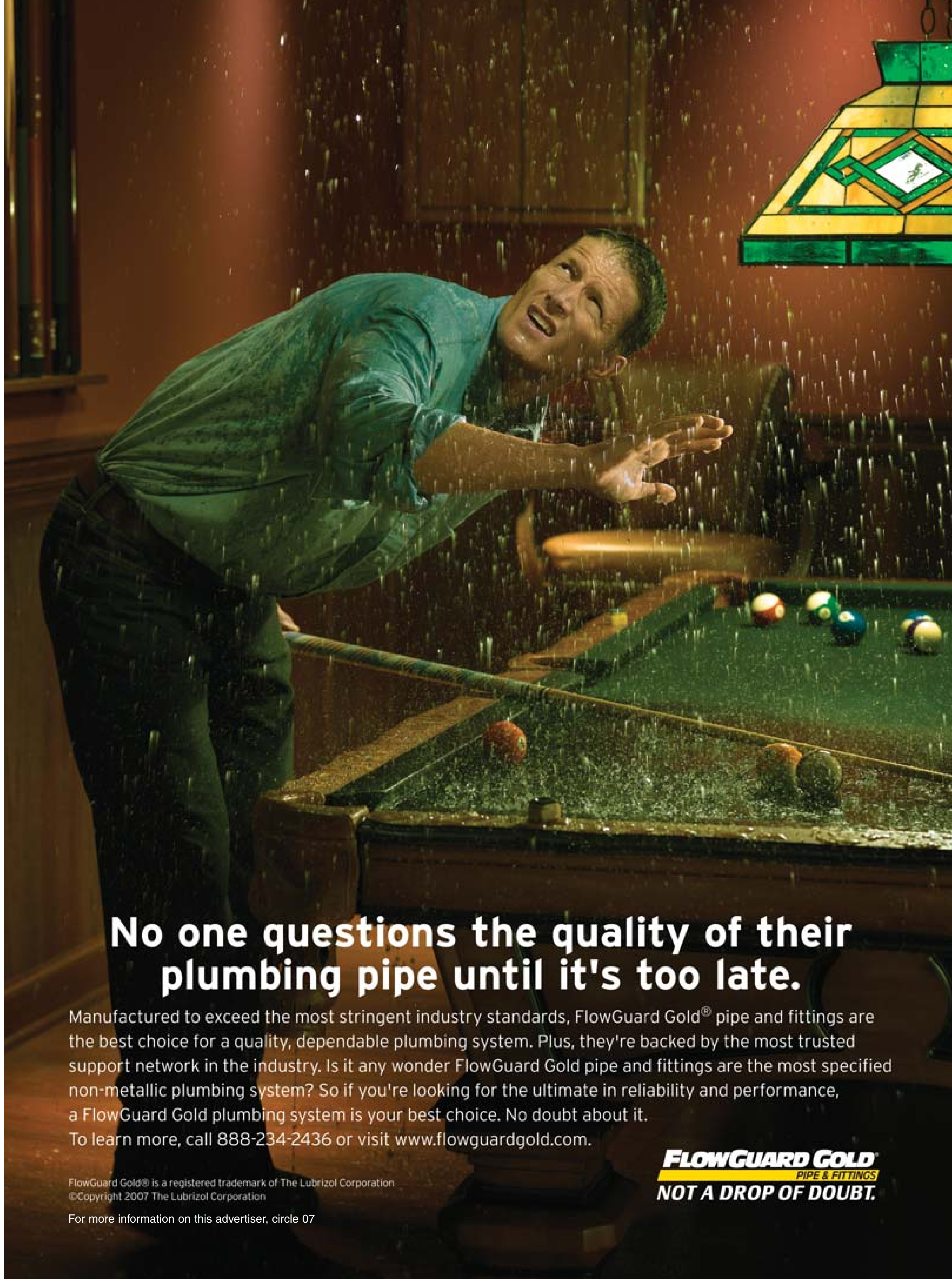

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The First Optimum Performance Home™

LEED for HOMES

fire risk mitigation part XI

Gary Reber

Architectural Illustration By Ronald Devesa

synopsis

- The home design embraces traditional fire safety measures, including multiple Uponor fire sprinklers, smoke detector alarms, PEARL® Protected permanent escape and rescue ladders, and evacuation plans to get out of the house, but applies new technologies that make it possible to save the home as well as its occupants by preventing a fire before it starts.

- Whether or not a fire engine and crew visits a home in wildfire conditions depends mostly on the homeowner's preparation—how the home is built; what plants surround it; the access to reach it; if water is available that can be tapped by fire engines.

- There are four major areas, which have been addressed to build a wildfire-safe home:
  • Exterior walls will be heat- and fire-resistant so as to resist both combustion and radiant heat transfer to the interior.
  • A Class A fireproof structure will prevent ignition.
  • Exterior projections will be fire resistant.
  • Careful selection and maintenance of vegetation around the home to prevent pass-along ignition.

Introduction

This is the eleventh article in the series documenting the design and construction of the first Optimum Performance Home™. The project has been selected by the U.S. Green Building Council (USGBC) for inclusion in the national Leadership In Energy & Environmental Design (LEED®) for Homes pilot program, their new green build certification initiative, and the goal is Platinum certification.

The home will be built at The Sea Ranch, located in Sonoma County, along the Northern California coastline of the Pacific Ocean, approximately 110 miles north of San Francisco.

The showcase project is exemplary of the "Ultimate Home Design®" concept, which integrates age-friendly universal design with the best sustainable building practices, while exerting minimal impact on the natural environment. Universal design is the inclusive, non-discriminatory design of products, buildings, environments, and urban infrastructure, as well as information technologies that are accessible to and useable by (almost) all. With respect to home design, the idea is to design and build homes that have no physical barriers, thus sustaining people of all ages and all capabilities in a functional, comfortable, and aesthetic lifestyle.

A building science systems approach to home building is the cornerstone of the project, with emphasis on the relationship between the home's components and the envelope they create. Also paramount is good stewardship—proper regard and respect for the rights of neighboring homeowners and the surrounding natural setting, and resource efficiency. The goal is to optimize occupant health, comfort, and safety; maximize energy efficiency and structural durability; and minimize environmental impact. In addition, the aim is toward providing a nurturing home environment to support independent living and sustainable lifestyles.

Part I of this case study series appeared in Issue 1, January/February 2006. The introductory article covered the project scope. Thereafter, each issue has contained a part of the continuing series by working through site planning and preparation; Low-Impact Development (LID); further refinements to the site plan and drainage design; The Sea Ranch Design Committee-approved architectural/structural and grading/drainage submittals with conditions that translated to clarifications on certain building components and material finishes; particular aspects of the home's mechanical plan; structural aspects of foundations, structural walls incorporating Insulating Concrete Forms (ICFs) and Structural Insulated Panels (SIPs), as well as roofing; the acoustical design of the dedicated Optimum Performance Home Theatre™ and rear-projection room; interior design approaches and materials; kitchen, bath, and home fixtures; and universal design architecture.

A Final Approval letter for The Sea Ranch Association Construction Performance Permit was issued on October 11, 2006, which is required by Sonoma County prior to obtaining a county building permit.

The necessary work to secure the building permit has been completed. Final construction plans have been approved by the Sonoma County Building Department. Six permits have been issued: site plan, landscape plan, septic system, geothermal bore holes, grading, and building. Commencement of construction with initial site grading, foundation, and mechanical infrastructure is scheduled for early September 2007.

In this issue, the focus will be on the fire safety features of the home.

> "The Fire Protection Plan documents the ways in which the Optimum Performance Home has been designed and will be built to minimize and mitigate the potential for loss from wildfire exposure."

The Sea Ranch, Sonoma County, California
Aerial Photo Courtesy Scott Simpson

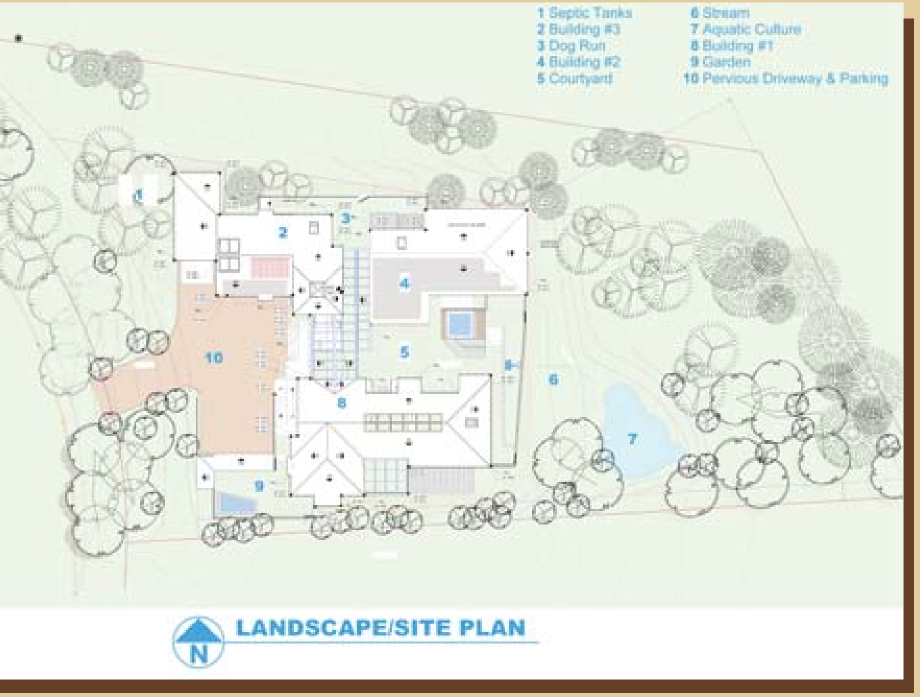
Design Concept

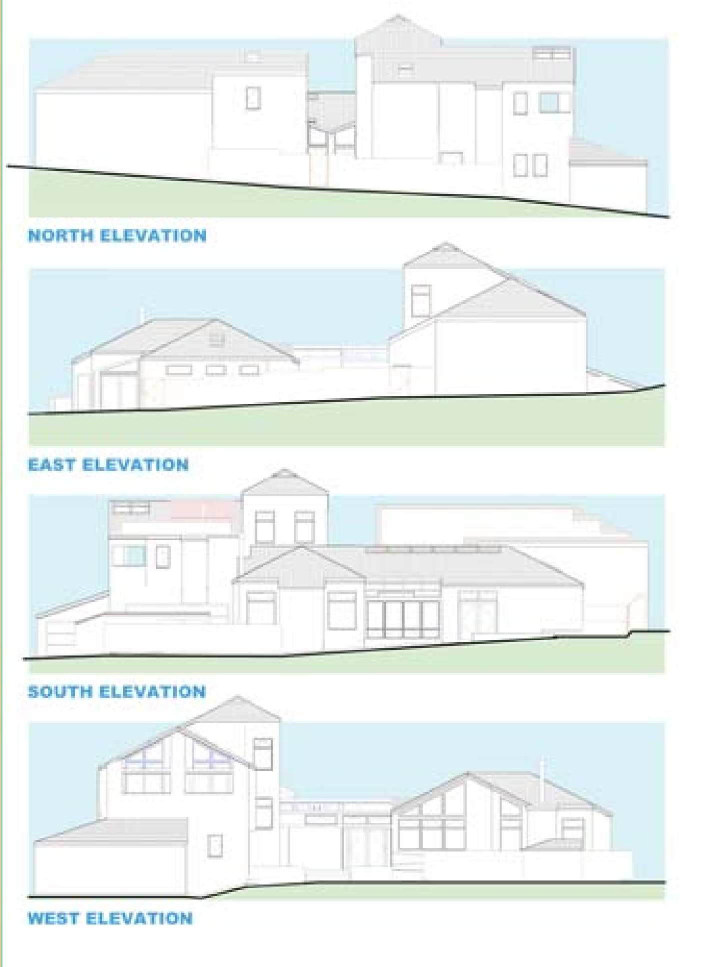
As previously noted in this series, the home design integrates all of the concepts advocated in *Ultimate Home Design*. The goal is to demonstrate how modern building products and methods can make life safer, more comfortable, and more enjoyable. The science of optimum performance homes concerns itself with building structures that use less energy, are quieter and more comfortable, have fewer problems with material degradation, provide clean air and water, and do less damage to the environment. As an integrated and holistic design, the house will serve as a permanent residence that allows its occupants to age in place.

The high-performance building systems to be employed are designed to exceed building code requirements, and resist natural disasters more effectively than a code-minimum house. Built with stronger building materials and superior techniques, the home will be safer, allowing homeowners greater peace of mind. The Optimum Performance Home qualifies for the Fortified…For Safer Living® program of the Institute for Business & Home Safety (www.ibhs.org/business_protection). This program specifies construction, design, and landscaping guidelines to increase a new home's resistance to natural disaster.

In addition, the home will meet the guidelines and qualifications for the U.S. Department of Environmental Protection's ENERGY STAR®, the EPA's (Environmental Protection Agency) WaterSense®, and the American Lung Association® Health House® programs. It also will meet the requirements of the National Association of Home Builders' (NAHB) Model Green Home Building Guidelines, the Sustainable Buildings Industry Council (SBIC) Green Building Guidelines, and the "Green Points" program. Sonoma County and The Sea Ranch Association are now considering this program for adoption.

Furthermore, the home's design will be the subject of a case study analysis presentation before the Custom Residential Architects Network (CRAN), Full Spectrum Practice Convention





The elevations of the Optimum Performance Home at The Sea Ranch

of the American Institute of Architects on October 20, 2007 in Chicago, Illinois.

The home is also a case study of the California Energy Commission in terms of energy-efficiency applications and an advanced water-saving plumbing plan.

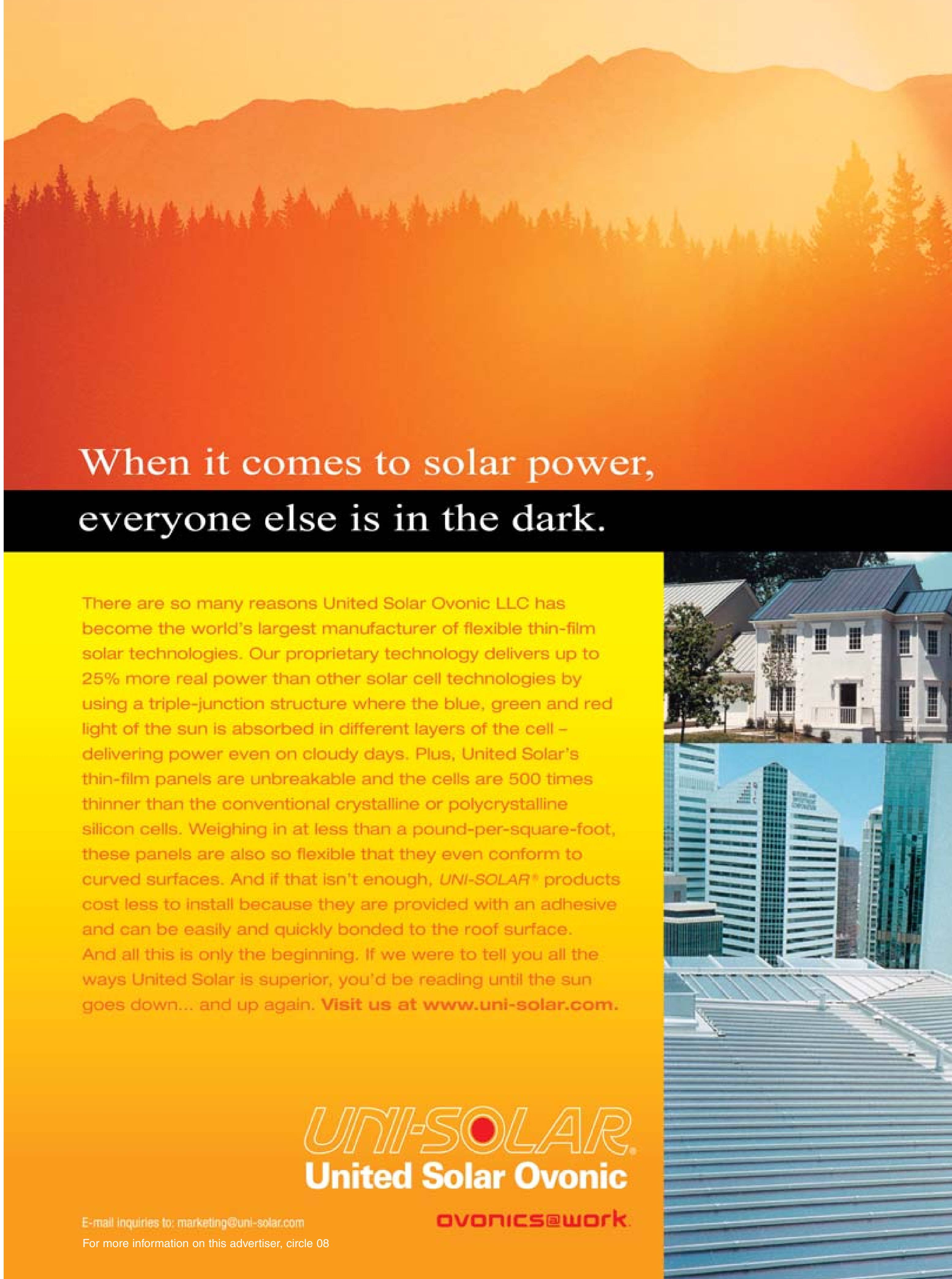
Finally, the home is a national showcase for CEDIA (Custom Electronic Design and Installation Association), and is the subject of a series of articles on the design and installation of the electronic lifestyle components in the home.

The Setting

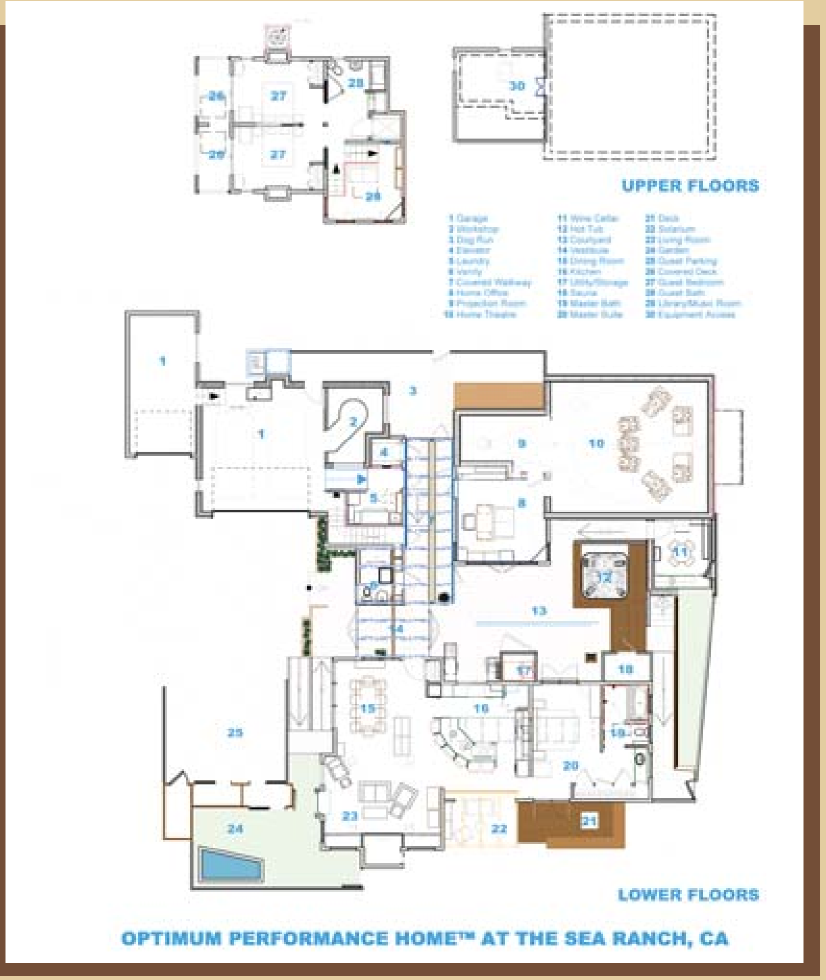
The Sea Ranch is an internationally renowned 5,000-acre environmentally protective residential development situated within a pastoral and forested coastal enclave and nature preserve approximately 110 miles north of San Francisco, California. This stunning development, now celebrating its 42nd anniversary, straddles a ten-mile stretch of Highway 1, ending at the northern tip of Sonoma County and the south bank of the Gualala River.

The Sea Ranch is widely regarded as a unique and remarkable residential development. During the 1960s and 1970s, The Sea Ranch was at the forefront of environmentally responsible development. It was conceived and designed by architects and landscape architects who wanted to provide a harmonious mixture of custom homes and pristine natural Northern California landscape in oceanfront, meadow, and forest environments. In fact, The Sea Ranch concept and its architecture are recognized in schools of architecture around the world, and it is frequently used for case studies in environmental and architectural design. The first condominium complex to be built on the southern coastal bluffs of The Sea Ranch is now a registered national architectural site.

Single-family development occupies approximately 2,500 acres without borderline fences or other visible delineation of property lines. The remaining acres are permanent green-scape commons and nature trails for walkers, bicyclists, and equestrians.



DESIGN
optimum performance home



OPTIMUM PERFORMANCE HOME™ AT THE SEA RANCH, CA

Each home is custom designed by an architect/architectural designer following site-specific design guidelines and is situated off a private road network without curbs, sidewalks, or streetlights. The Sea Ranch is a very unique residential development woven into a tapestry of buildings and nature and committed to environmental preservation. The development includes 2,288 lots for single-family custom homes, with 544 remaining to be developed (1,744 already developed and 27 under construction).

The Sea Ranch is managed by The Sea Ranch Association, a Common Interest Development (CID) with an elected volunteer Board of Directors, and supported by numerous volunteer committees. All development on The Sea Ranch is subject to design review and the approval of a Board-appointed autonomous Design Committee. The Design Committee is presently comprised of architects and landscape architects. A legal set of Covenants, Conditions, and Restrictions (CC&Rs) govern the development and are designed to protect The Sea Ranch concept.

Fire Risk Mitigation History

Before the land was The Sea Ranch, Native Americans and ranchers often set small fires to help nature out and to improve their food sources, rangeland, and hunting. But after the turn of the 20th century, man has interrupted this natural cycle of fire. So many homes have been built in wildland areas that fires are no longer free to do their job and consume dead brush and fallen trees, and open up travel routes for wild animals.

Most wildfires start in windy conditions and create more wind of their own. Wind at The Sea Ranch, and along the Pacific coast, is a natural occurrence. "Controlled burns," once an option, are today too difficult and are rarely attempted. Instead, there has been a huge buildup of flammable vegetation and unhealthy trees, densely tangled and too crowded, with no room to flourish, due to missed cycles of normal wildfires. This means that future wildfires will burn more intensely and will do much more damage than wildfires of the past. Future wildfires will have to be vigorously fought to protect home development. Given this scenario, it is imperative that homeowners and their communities learn to live with wildfires and take action to protect themselves and the environment from their unwanted consequences.

In the early years of The Sea Ranch, the landscape was rather bleak and barren, except for areas of new-growth redwood and Douglas fir established after logging of the old growth and during the start of development. Early on, fire danger was not perceived as a high risk because fuel load was minimal, and the long grasses on the meadows were maintained with controlled burns.

Unfortunately, during those early years, the developer, Oceanic California, Inc., planted some 400,000 non-native shallow-rooted Monterey and Bishop pines, now referred to as "the pine plantations." Far too many survived, growing much too close together. The resulting unnatural "forest" now blankets the hillside sections east of Highway 1 along the entire ten-mile length of The Sea Ranch, leaving only a smattering of meadows and bare hillsides. The dense vegetation and trees, all roughly the same age and height, make perfect fuel for a wildfire. The west side of Highway 1 remains as a meadow without any forest, where natural grasses are the predominant ground cover. There, "signature" but decadent flammable cypress hedge-groves grow along the bluff perpendicular to Highway 1. These decadent and easily ignitable pine plantations, and other proliferating trees, already present in the hills are continuing to age and deteriorate at the same rate, producing a grave fire danger.

Viewed with this historical perspective, the vegetation east of Highway 1 is "on steroids," and much of the man-created unnatural forested areas have not been managed for fire safety in the 42-year history of The Sea Ranch. Add to this flammable mix the presence of over 1,700 wood-constructed homes, and it is clear that The Sea Ranch is in present danger of a wildfire with sufficient fuel to be devastating.

Granted, the people who want to live at The Sea Ranch are seeking "rural living" away from the cities and know full well the consequences should a wildfire occur. Yet, reasonable people, including those engaged in designing and building homes for full-time living see the need for a greater effort to mitigate the fire danger, especially in the forested areas.

Since its inception, The Sea Ranch has required all houses to be built of redwood or cedar. Only five years ago did the Design Committee first begin to permit fiber-cement siding. Class A fire-resistant roofing such as composites, stone slate, and metal are permitted as well.

The Sea Ranch CID is set up such that each property owner has an equal share ownership in the common areas, the bulk of which are the forested areas and meadows. The governing CC&Rs dictate that the Association maintains ALL the commons in good condition, as does state law. But, in fact, the Association has neglected to maintain the forested commons since the inception of The Sea Ranch.

The Sea Ranch is defined as located within a designated Wildland-Urban Interface. The Sea Ranch contracts with CalFIRE, formerly the California Department of Forestry and Fire Prevention, to provide all community fire protection. The state operation is located at the fire station on Annapolis Road and is within a 75-second drive to the planned home's site. A fire hydrant is located near the road curb within less than 100 feet to the south of the site. The Sea Ranch Volunteer Fire Department is located at the fire station off the northern end of Highway 1. Both stations are also located in a Very High Hazard Severity Zone. And because the community is isolated with long travel times for out-of-area resources, fire suppression resources are very limited should a wildfire occur, at least in the initial stages of the wildfire.

CalFIRE is responsible for enforcing California's Public Resource Code (PRC) 4291 within The Sea Ranch development. The booklet, *Living With Fire In Sonoma County* (www.firesafesonoma.org/living_with_fire.htm), outlines the standards and guidelines that Sonoma County fire agencies are using when "advising" homeowners about defensible space. Currently, a focused effort is underway to inspect lots with homes, but there is no plan to address

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the issue of undeveloped lots or the Association-responsibility commons.

In 2002, The Sea Ranch Association funded the Fuels Management Plan (FMP). While the FMP has had the laudable goals of increasing fire safety and has shown some effectiveness in reducing risks on both the immediate west and east sides of Highway 1, it has not received sufficient funding to fulfill all of its goals. Nor has the FMP reduced any significant amount of fuel load on The Sea Ranch. But then, it wasn't designed to do such. It was primarily designed to increase the safety of passage along roads and to slow down a non-crowning fire. Still imperative, however, is that decadent vegetation and trees be thinned in the forested areas, so that in the event of a wildfire, the fire won't burn as hot and consume as much acreage.

Aside from the FMP, The Sea Ranch Association at this time has no comprehensive program or any annual budget to reduce the number of decadent trees, undergrowth, and vegetation in the meadows to prevent the spread of forests.

One of the important aspects of PRC 4291 and the associated Forest Service Guidelines is that they emphasize the requirement for a 100-foot defensible space around structures but limit the homeowner's responsibility to the property line if it is less than 100 feet away. Homeowner implementation of PRC 4291 requires that homeowners obtain approval for vegetation removal from the Design Committee and the Department of Design, Compliance & Environmental Management (DCEM). However, the CalFIRE-required reviews and approvals for defensible space vegetative maintenance should now override this layer of bureaucracy. But whether this will happen is yet to be determined. CalFIRE may issue notices warning of potential dangers but they will not provide enforcement. They intend for their notification process to be only "educational" at this time, and they have no staff or budget for enforcement.

The costs of providing for defensible space at The Sea Ranch can be divided into three categories:

- Lot owners for their own developed private property areas as defined by PRC 4291
- Lot owners for their undeveloped private property areas as provided for by CC&R Section 3.02 (d), which states that the owner is responsible for maintenance in a fire-safe condition
- The Association for restricted private and adjacent common areas, as provided for by CC&R Section 5.04 (d), which states that the Association shall be responsible for maintenance of common and restricted private areas [which is approximately 60 percent of The Sea Ranch and includes most of the hazardous acreage, including the fire chimneys and the deteriorating pine plantations].

The Sea Ranch Association has created yet another volunteer study group, the Fire Safety Task Force (FSTF), which has been directed to further study and define fire risks. It will seek additional ways to improve fire safety, and monitor the Fuels Management Plan for maximum effectiveness. The 18-month effort is expected to recommend fuel-load and vegetation management measures. Eventually, the FSTF will report their findings to the Board for possible action.

Yet report after report over the past 30 years has identified all of the fire-risk conditions and the remedial actions required. Over those many years, every report and study regarding managing vegetation has been sensitive to Forestry Guidelines, fire expert advice (including arborist recommendations), and regard for habitat aesthetics, environmental stewardship, and protection from re-forestation of natural view corridors.

The Sea Ranch community is faced with an increasing danger that continues to threaten life (human and animal) and property, while the Association continues to overlook CC&R directives and state law mandates for maintaining ALL of the commons.

No amount of fire-risk mitigation can fireproof The Sea Ranch. Any home in an environment such as The Sea Ranch is at risk, but fire science is increasingly knowledgeable about mitigating those risks through appropriate vegetation management and building codes that require fire-resistant building materials and applications.

There are three factors in wildfire: climate, terrain, and fuel. The weather cannot be changed, nor the terrain. But the fuel can be reduced and the vegetation managed for fire safety. And doing so should be a first principle for people who choose to build homes in a Wildland-Urban Interface zone, not only for their own safety, but for the protection of the wildlands as well.

With this background one might ponder why anyone would want to put his or her life and property at risk with the ever-present danger of a wildfire. Some people will always place high value on the beauty of the natural environment and want to be invigorated by this beauty on a daily basis. That is why we chose The Sea Ranch site for building the first Optimum Performance Home. The natural environment is gorgeous and features stunning coastal views, trees, ocean bluffs, coves, meadows, and trails.

Unlike other Sea Ranch homes, the planned Optimum Performance Home will feature "green" sustainable build quality, universal

aging-in-place living design, and comprehensive electronic lifestyle features. The home is deliberately designed to fully survive a wildfire through a careful selection of building materials and techniques designed to mitigate fire risk.

The Home

The Sea Ranch Design Committee imposes upon designers architectural building blocks derived from the original rural structures found on the northern California coast. Designers are expected to apply their creativity to render various arrangements and deviations to arrive at a custom solution that specifically responds to the site. Successful proposals submitted to the Design Committee address the issues of passive solar positioning, wind, glazing (window) layout, privacy between neighbors, vegetation protection, view preservation, topography and grade changes, roof slopes, appropriate exterior materials and finishes, and other exterior design considerations—all within the building and site design.

A focus of the Optimum Performance Home's design is to stand as a showcase for the "green" movement and demonstrate means of reducing a home's impact on the planet through the use of Low-Impact Development (LID) and environmentally responsible building materials. It is hoped that the home will become a case study for a "Green Points Program" suited to the scale of The Sea Ranch.

The home's 3,272-square-feet living space (4,441-square-feet total building "footprint," including garages, covered walkways, courtyard, and decks) will be arranged in a three-building compound using a well-sealed, well-insulated, super-tight building envelope that reduces temperature fluctuations and enhances overall energy efficiency. This arrangement provides for an alcove courtyard protected from the prevailing wind from the northwest. The home is designed with differing spatial experiences throughout to encourage exploration. The home will display innovative interior design and be furnished in a contemporary Frank Lloyd Wright style appropriate to its dimensions. The home design connects the indoors and the outdoors with covered walkways, a courtyard, decks, and a garden to expand livable space, without requiring heating or air conditioning. The home is designed in accordance with biophilic-design principles with abundant and excellent use of natural light and natural indigenous landscaping planned. (For an in-depth analysis of the biophilic attributes of the home, please read "Biophilic Design," "Biophilic Design Attributes," and "The Interior Design Process, Part I: Synthesizing Sustainability, Universal Design, And Technology" authored by Julie Stewart-Pollack in Issue 3 (May/June 2006), Issue 4 (July/August 2006), and Issue 10 (July/August 2007), respectively.

The main-floor living area is designed to accommodate the capabilities of all occupants without any challenging physical barriers, even for the elderly and disabled. The home design features a ground-level open plan for the living room, dining room, master bedroom suite, and spacious kitchen with solarium, exhibition cooktops, and home management system.

The second building in the compound is designed to accommodate a large state-of-the-art Optimum Performance Home Theatre™ with integrated rear-screen projection room and a home office.

The third building will include a two-car and boat garage, workshop, main-level guest bathroom, and laundry room. The second level of this building will have two guest bedrooms, a bathroom, and a dedicated library/home theatre/surround music room distinguished by a high-tower feature. To insure universal access to this floor, the design provides for an Otis® Gen2 residential elevator.

The entrance and walkways that connect the three buildings and the solarium will be enclosed with insulated- and solar gain-reduced-tempered glass. There will be a seating area at the vestibule entrance to the home. The main entrance vestibule will serve as an oversized mudroom. The driveway, area around the garage, guest parking, and entrance to the home—as well as all paths—are designed in accordance with The Sea Ranch guidelines governing exterior hard-surfaced paths. All such surfaces are pervious to virtually eliminate water runoff. The surface will be packed with decorative gravel to enhance the natural appearance of the home's setting. There also will be a dedicated equipment room off the courtyard, which accommodates the Uponor® and WaterFurnace® radiant-heating apparatus, TrendSetter® solar hot water storage tanks, Microtherm's Seisco® on-demand electric tankless water heater, and other equipment. The backup Kohler® generator is housed within a separate weather-resistant enclosure located off the wind tower on the north wall of the two-car garage and guest bedroom, within the fenced dog run. This tower is designed to optimize the northwest wind performance of the PacWind® Seahawk® vertical-axis Savarrieus™ wind turbines disguised within. The dual turbines will produce from one to five kilowatts of power.

The home site is nestled on an almost-acre parcel at the edge of a forested area of the southern section overlooking the Pacific Ocean, offering distant water views. Some of the home's features will include a Benissimo® slate-floor outdoor courtyard, two hardwood Ipé deck areas, in-ground Dimension One Spa® hot tub, Finnelo® Finnish sauna, and underground wine cellar. The orientation of the home on the site is designed to take advantage of natural lighting and passive solar heating and cooling. Good site and land planning will result in minimal land disturbance and preservation of natural features and environments.

Landscaping will consist of The Sea Ranch-approved indigenous vegetation with low-water requirements and unique water conservation features, including two ponds and a stream supported by rainwater catchment and captured runoff. Site grading has been specifically planned to enhance the project's placement in the watershed, and the design incorporates the principles of Low Impact Development to minimize runoff from impervious surfaces and mimic the natural hydrology in overall effect. The resultant water harvesting will then minimize the use of irrigation, and the increased infiltration and retention will passively support the native landscape. Additionally, a gray water system will be used for undersurface plant irrigation.

Fire Risk Mitigation Features

What follows is a Fire Protection Plan, which documents the ways in which the Optimum Performance Home has been designed and will be built to minimize and mitigate the potential for loss from wildfire exposure. In areas that are designated Wildland-Urban Interface Fire Areas and/or Very High Fire Hazard Severity Zones by the office of the State Fire Marshal pursuant to California Public Resources Codes, such as The Sea Ranch, certain building standards apply to mitigate wildfire exposure. Wildfire exposure is one—or a combination of—radiant heat, convective heat, direct flame contact, and burning embers projected by vegetation fire, which can travel as much as a mile away from a wildfire to a structure and its immediate environment.

Traditional fire-safety education focuses on smoke alarm installation and escape techniques, including evacuation routes. The design of the Optimum Performance Home embraces this strategy, including multiple Uponor fire sprinklers, smoke detector alarms, PEARL® Protected permanent escape and rescue ladders (accessible from second-story living quarters), and evacuation plans to get out of the house, but applies new technologies that make it possible to save the home as well as its occupants by preventing a fire before it starts.

While most of the existing building-code requirements that relate to fire danger have been derived from decades of experience in urban fires, changes are being evaluated and will be forthcoming in the near future, based on the experiences of recent years from losses in wildfires in the west.

Red-hot burning embers or particles falling from the sky will start fires only where there's fuel for them to burn. The home design's objective is to keep flames away from the home and to eliminate combustible building material that would otherwise be open to attack from flying embers.

Whether or not a fire engine and crew visits a home in wildfire conditions depends mostly on the homeowner's preparation. This will depend on their assessment of whether the home is prepared and can be saved. If they see a wide driveway, a clearing around the home, and a place to turn around, they are more likely to protect the home.

Protection depends largely on these factors:

- How the home is built
- What plants surround it
- The access to reach it
- If water is available that can be tapped by fire engines

A principal design goal for the Optimum Performance Home is to incorporate building safety elements. In the case of the design of the structure, there are four major areas, which have been addressed to build a wildfire-safe home:

- Exterior walls will be heat- and fire-resistant so as to resist both combustion and radiant heat transfer to the interior.
- A Class A fireproof roof structure will prevent ignition.
- Exterior projections (eaves, decks, porches, cantilevers, etc.) will be fire-resistant.
- Careful selection and maintenance of vegetation around the home to prevent pass-along fire ignition.

The goal in the design of the Optimum Performance Home is to build a Survivable Home—one that will survive without firefighters' help.

Site Treatment And Exteriors

All vegetation near the structure has been carefully selected and will be maintained to reduce the flames and heat that could attack the home in the event of a wildfire. This is the area referred to as part of "defensible space," in which vegetation is cleared back from the home enough that the home is "defensible"—able to be defended—in a wildfire.

Effective fuel reduction means arranging the trees, shrubs, aerial above-surface brush, and other fuel sources in a way that makes it

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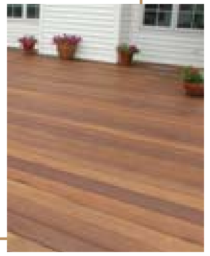
EarthSource Forest Products Ipé Decking

• EarthSource Forest Products FSC (Forest Stewardship Council)-certified Ipé decking will be used for the master bedroom suite deck and the guest bedroom decks. Ipé is perhaps the hardest wood available and is extremely durable and ideal for outdoor decking applications.



PEARL® Protected Permanent Escape & Rescue Ladder

• A PEARL® Protected Permanent Escape And Rescue Ladder will be installed in each second-story guest bedroom and the library/home theatre/surround music room. Pearl provides the ultimate escape solution in the event of a fire or other home emergency.

difficult for fire to transfer from one fuel source to another. Plants will be separated from each other vertically and horizontally to prevent a fire from jumping from grass to brush to trees ("ladder" fuels), or from bush to bush or tree to tree. No grass will be permitted to grow below and near brush or shrubs. Tree branches will be pruned at least six feet, up to 15 feet from the ground, so that anything burning below them won't catch the trees on fire, and also for fire engine access.

The site has a gradual slope to the east, as the terrain rises gradually from the bluffs along the Pacific Ocean. Fires will run uphill hotter and faster than on level ground. The clearing distance downhill around and in front of the home to the frontage street will be maintained in a fire-preventive natural vegetative state. Dead and diseased trees, branches, and bushes will be removed as well as dry grass, twigs, needles, wood chips, and dead leaves on the ground, so burning embers won't have the fuel they crave in the event of a wildfire.

The master bedroom suite Ipé deck will be clear underneath to bare soil and enclosed with non-flammable material so that flying embers or a grass fire cannot burn beneath and start the structure on fire. Ipé is an extremely dense hardwood that is ignition-resistant and virtually non-combustible at three inches thick, especially when coated with No-Burn® fire-retardant protection before staining.

All plants surrounding the home will be those that are native to the region, as they were when the first residents settled the region. They have co-evolved with the wildlife, fungi, and microbes to form a complex network of relationships. Native plants promote water conservation and can survive with only seasonable rainfall. Thus, less water consumption means more water available for firefighting—a particular benefit during a drought. All natural grasses will be mowed and maintained to a height of four inches maximum.

The design of the driveway provides safe emergency vehicle access and egress. The 50-foot straight-path driveway will be 12 feet wide with a large guest parking area at the front of the home that will provide for a three-point turn for fire engines. The grade is eight percent—not too steep for navigating fire equipment. A numbered address sign will be visible from the road from at least 100 feet in both directions in a fire engine's headlights. The copper sign will have reflective numbers four inches tall.

A pathway will surround the compound structures, which will serve as an access for firefighters to work. The wide driveway and pathway will serve as a firebreak between the home, neighboring vegetation, and the nearby wildlands.

An 11,000-gallon surplus supply of water will be available from the pond, which will be located approximately 100 feet uphill from the home, with a three-inch filtered underground water line down to the home. A standard 2-1/2-inch value red-painted standpipe hydrant with a male National Hose fire-thread fitting will be located at the driveway entrance at the front of the boat garage, to which a fire hose can be connected. The pond and gravity hose will be able to provide 250 gallons-per-minute without a pump. The firewater fittings will be painted red, and the location of the water source marked with a blue reflector and a "fire water" sign at the entrance to the driveway pointing to the water connection and source. Fire engine access to within 12 feet of the pond will be provided.

In-ground accessible water hoses will be positioned at each building corner, and on decks, to be used to dampen falling burning embers and keep temperatures below ignition of combustibles, in the event of a fire. These in-ground hose receptacles will be covered with a non-combustible easily removable lid.

The propane tank will be buried in a concrete enclosure located 40 feet away from the home in a non-flammable aboveground storage structure next to the non-flammable garbage structure.

While The Sea Ranch still stipulates that fences be made of wood, the design provides for separating the fenced areas from the home using metal gates or open space to prevent a fence from touching the structure. Otherwise, a wood fence can carry a fire right to a deck and the home.

The underground wine cellar has been designed to provide an emergency fire "safety zone" cocoon to hunker down in while a fire passes.

The Structure

In wildfires, homes, in many cases, initially combust by radiant transfer of heat through the exterior shell of the home so that the interior furnishings

DESIGN
optimum performance home

combust in a burst of flame that rapidly engulfs the structure. Amvic® Insulating Concrete Form (ICF) and IHSN ThermaSAVE® Structural Insulated Panel (SIP) walls and roofs, as well as Industrial Acoustics Corporation (IAC) STC-61 Noise-Lock steel door assemblies, heavy solid-wood Holzkraft® interior doors, and Artistic® 90-minute fire-rated 1-3/4-inch thick doors, will, along with the solid insulated walls, protect the interior of the home from radiant transfer. Artistic doors are crafted with their patented one-half-inch panel rated at 90 minutes, and are available with a glass panel insert, which will be the style used in the home. The Artistic doors will be used for the first- and second-floor openings to the Otis Gen2 residential elevator and the garage opening to the vestibule walkway. The IAC doors will be used at the entrance to the Optimum Performance Home Theatre and the rear-projection room.

As noted, the Optimum Performance Home will be built with non-combustible and impact-resistant exterior walls. The Amvic ICF walls will provide a solid flat wall of concrete sandwiched between two layers of expanded polystyrene (EPS) foam. The minimum thickness of the Amvic ICF exterior walls is nine inches, which will provide a building shell with a wall-fire rating of greater than three hours. A five-hour firewall will be created with the application of 7/16-inch thick MaxiTile® fiber-cement fireproof cladding panels and trim on the exterior and fire-rated sheetrock on the interior. The main residence, home office, and boat garage will use MaxiPanel® as the exterior and interior cladding for the ThermaSAVE Structural Insulated Panels (SIPs) that form the 8-3/8-inch-thick walls using non-combustible EPS foam as structural insulation sandwiched between the MaxiPanels. The roofs also will be constructed with the ThermaSAVE/MaxiTile SIPs and covered with non-combustible Class A Evergreen Welch Black stone slate tiles. Class A roofing assemblies are effective against severe fire exposures. Even the Ashland® ISOSET® adhesive, which will be used to glue the MaxiTile panels to the EPS panels, is non-combustible. As with the other materials, the adhesive is free of VOCs (Volatile Organic Compounds). MaxiPanel and MaxiTrim® will be used to create the board and batt exterior of the home.

Fiber-cement components are very stable and include Portland cement and silica sand, as well as mineral aggregates and cellulose fibers. The characteristics of fiber-cement materials have

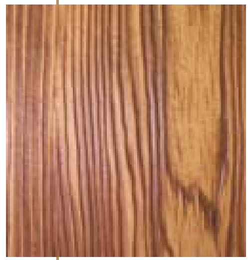
Amvic® Insulated Concrete Forms

• The Amvic® ICF 5-in-1 system incorporates structure, insulation, vapor barrier, sound barrier, and studding attachments for drywall and exterior siding in one easy step.

ThermaSAVE®

• The IHSN ThermaSAVE® Structural Insulated Panel Building System consists of a MaxiTile® inner and outer fiber-cement skin and a core of super-insulating expanded polystyrene (EPS) glued together with a special high-strength glue and dried under extreme pressure, resulting in a stressed-skin panel that has amazing capabilities.

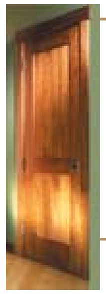
MaxiTile®



• MaxiTile® provides a 50-year limited transferable product warranty on its MaxiPlank®, MaxiPanel® and MaxiTrim® fiber-cement products. The products are dimensionally stable and resist cracking, rotting, and delamination. As well, they resist damage caused by extended exposure to moisture, humidity, UV rays, and salt air. And they are non-combustible.

Industrial Acoustics Corporation (IAC)

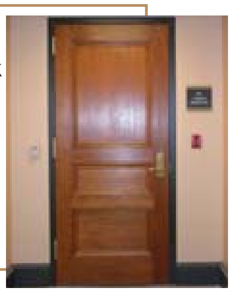
• IAC STC-61 Noise-Lock steel door acoustical assemblies feature cam-lift hinges, allowing a barrier-free sill—important for universal design considerations (the door rises as it opens, and falls as it closes), magnetic-type triple seals, and magnet sleeve bellows that reach out to provide a continuous seal around the perimeter of the assembly.



Holzkraft® Custom Wood Doors

• Holzkraft® custom stain-grade wood doors will be used throughout the interior of the Optimum Performance Home and as the entry door to the wine cellar. Stile-and-rail construction methods produce crisp, clean lines that are architecturally correct.

Artistic® Doors



• Artistic® 90-minute fire-rated 1-3/4-inch thick doors are meticulously handcrafted and are made from the finest materials, with hardware available to ensure long-lasting beauty, reliable performance, and low maintenance.

Evergreen Slate Company

• Evergreen's 11 natural slate colors and texture afford many architectural effects, contributing to a building's appearance. Slate quarried for roofing stock is of dense, sound rock, exceedingly tough and durable. It is also fire- and waterproof and resistant to climactic changes, with absolutely no disintegration. Evergreen slate has the highest designation for durability in excess of 75 years.

TrendSetter® Industries' Evacuated Solar Tube Collectors

• TrendSetter® solar-tube systems reduce the water-heating portion of a utility bill by as much as 90 percent. Each of the solar collector arrays are made of 30 non-combustible borosilicate impact-resistant evacuated glass tubes with a copper super-heat pipe and aluminum heat fin within each tube.

Carriage House Garage And Barn Doors

• The Carriage House Door Company has crafted thousands of exquisitely designed overhead garage doors for discriminating customers across America. Every door in their Carriage House Collection offers the timeless beauty, authenticity, and quality of doors constructed a century ago, yet they have completely modern functioning.

always been exceptional, such as their structural resistance to impact, weather conditions, and fire. MaxiTile's fiber cement contains three tri-hydrated alumina, which strongly increase its structural properties and its fire resistance.

MaxiPlank®, MaxiPanel, and MaxiTrim fiber-cement exteriors have been tested in accordance with the American Society of Testing Materials standards and other testing development organizations to be non-combustible (ASTM E136), approved for fire-rated construction (ASTM E119), and have zero flame spread (ASTM E84). Under UBC 2-1, MaxiTile fiber-cement products have zero smoke generation and fuel contribution. The National Wildland/Urban Interface Fire Program's Firewise Communities lists fiber-cement siding among steps to reduce a home's vulnerability. MaxiTile fiber-cement products are designed to protect the entire exterior of the home with flame-resistant siding and trim boards for corners and around windows and doors. MaxiPanel Cedar and MaxiTrim will be used for the exterior of the Optimum Performance Home and MaxiTrim for framing doors and windows that are vulnerable to contact with fire. In the SIP application, MaxiPanel Smooth will be used as the interior facing and the surfacing for the roofs.

The TrendSetter® solar hot water system will employ TrendSetter's proprietary solar collectors on the southern roof above the guest bedroom. Each of the solar collector arrays are made of 30 non-combustible borosilicate impact-resistant evacuated glass tubes with a copper super-heat pipe and aluminum heat fin within each tube. The evacuated tubes are tied together with a single 30-tube header. The header consists of a fiberglass insulated copper manifold contained within a powder-coated aluminum casing which is mounted to the roof as a complete evacuated tube array with a stainless-steel frame.

Carriage House Garage and Barn Doors will craft the home's custom garage and barn doors. The doors will be overlaid with the same non-combustible MaxiTile fiber-cement cladding that will be used on the home's exterior.

Attic vents located in the roof above the Optimum Performance Home Theatre will be covered with a metal mesh screen with a small grid size to prevent wind-borne embers from penetrating into attic space. Chimney and stovepipe openings will also be covered with wire mesh 1/4-inch or smaller, with an approved spark-arrestor cap.

Gutters and places where roof angles meet can trap burning embers. According to the American Red Cross and the Federal Emergency Management Agency (FEMA), keeping gutters clean of debris (dry tinder) is an important practice for fire mitigation. When burning embers carry onto roofs and into gutters, homes are at a much higher fire risk.

The Gutter Helmet® gutter protection system will shield the home's gutters from burning embers and keep the home's roofs free of leaves, needles, and other debris using a flow-limiting, ribbed design that slows and spreads water, causing it to flow easily into the gutters, while debris falls to the ground, thus preventing dry tinder from collecting.

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Radiant heat from a wildfire can cause windows to shatter and melt window frames, allowing burning embers to enter the structure and cause more damage. The glass in exterior openings will be tempered and either dual- or triple-glazed and resistant to transmission of radiant heat from direct flame. Though there is no industry-approved uniform fire rating from dual- or triple-glazed windows and doors, windows and doors with glass components with an insulating-air-gap feature have proved their worth under actual fire conditions. The Optimum Performance Home will use Pella® insulating-air-gap tempered glass windows and VELUX® electronic-venting glass skylights (VSE) with four-sided aluminum inserts and exterior aluminum cladding to prevent fire from penetrating the building shell. VELUX skylights meet ASTM standards. The VELUX SunTunnel® skylight fitted to the ceiling of the underground wine cellar features a hemispherical-shaped acrylic dome that rolls any material hitting or landing on the dome to the sides. The unit features a steel ring to further inhibit damage. As with the VELUX fixed and fixed curb-mount units, the SunTunnel has passed ASTM Class B burn brand testing. Note that Class B roofing assemblies are effective against moderate fire test exposures. The ridge skylight will use VELUX tempered glass and a non-combustible aluminum assembly. The pyramid skylight over the library/home theatre/surround music room will use tempered glass and a non-combustible aluminum assembly. Additionally, Pella's integrated Venetian blinds within the air gap can be effective in holding out radiant heat.

Likewise, the Lindal®-built vestibule, walkway, and solarium will fabricated with tempered glass and aluminum exterior structural elements.

The Interior

The interior walls will be constructed with Nordic Structures' light-gauge (cold-formed) steel framing. In addition to being recycled and recyclable, steel has a significantly higher strength-to-weight ratio than wood and thus has greater earthquake resistance. Steel is non-combustible and does not contribute fuel to the spread of a fire, and steel is an inorganic material, which does not provide an environment on which mold can grow. The interior steel-framed

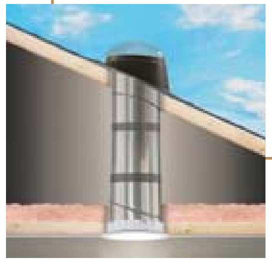
Gutter Helmet®

• The Gutter Helmet® gutter protection system is a multi-patented, flow-limiting, ribbed design that slows and spreads water, causing it to flow easily into the gutters, while debris falls to the ground.

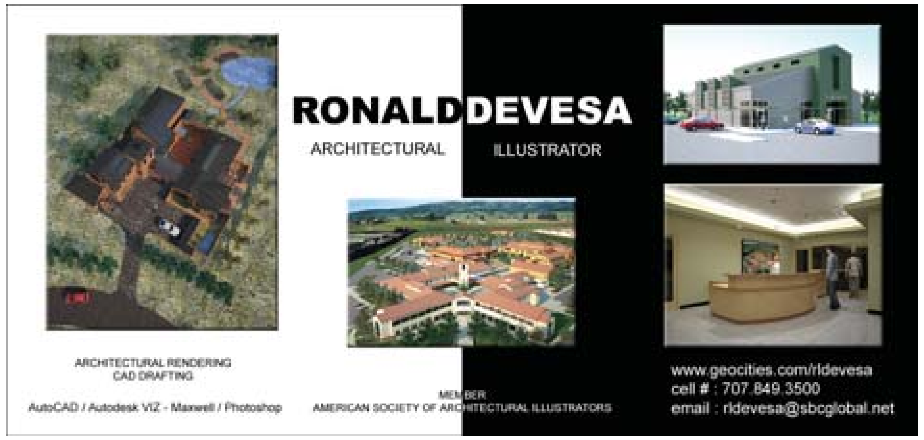
Pella® Windows And Doors

• Pella® Windows and Doors have been known for quality craftsmanship and innovation. Their EnduraClad® Plus and Seacoast Exterior Paint Finishes ensure superior weather ability and longer-lasting protection against chalking, fading, corroding, and exposure to the sun's UV rays. Pella quality extends to natural wood-framed interiors, which can be painted or stained to match a home's interior décor.

VELUX® Sun Tunnel™



• Accentuated by the natural stone walls and vaulted ceiling, an integrated VELUX® Sun Tunnel™ will project natural daylight into the wine cellar.



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Nordic Structures, LLC

• The advantages of light-gauge (cold-formed) steel framing is that in addition to being recycled and recyclable, steel has a significantly higher strength-to-weight ratio than wood and thus has greater earthquake resistance. Steel framing also is impervious to rot and termites. Steel is non-combustible and does not contribute fuel to the spread of a fire, and steel is an inorganic material, which does not provide an environment on which mold can grow.

Bonded Logic®

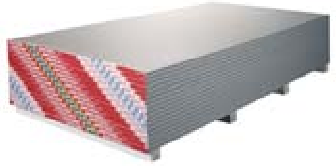
• Bonded Logic®'s UltraTouch® insulation product is 100 percent post-industrial recyclable and environmentally friendly insulation that provides maximum health and superior R-value thermal performance. It is Class-A fire rated, offers excellent thermal and acoustical properties, and is treated with a non-toxic mold, mildew, and pest inhibitor.

Acoustiblok®

• The steel-framed stud walls enclosing the Otis Gen2 elevator shaft and the laundry room will be surfaced with an Acoustiblok® UL (Underwriters Laboratories) assembly designed to soundproof these areas. Acoustiblok is the only particular formula that has passed UL's stringent requirements. Therefore, Acoustiblok has earned a Class A one-hour fire rating.

USG Sheetrock™ Firecode® C Core Gypsum Panels

• USG Sheetrock is composed of enhanced fire-resistant gypsum core (Type C) encased in 100 percent recycled natural-finish face paper and 100 percent recycled liner paper on the backside, possess superior fire-resistance and heat transmission properties for added safety, and are exceptionally resistant to cracks caused by structural, thermal, or hygrometric changes.



VELUX® Skylights And Roof Windows

• VELUX® is the only manufacturer with all standard skylights meeting ENERGY STAR® approval guidelines for all climactic regions of the U.S. VELUX remote-controlled venting electric skylights (Model VSE) are the ultimate skylight for natural daylighting, controlled fresh air ventilation, and eliminating condensation. VELUX also manufactures both a flexible and rigid Sun Tunnel™.

stud walls will be packed with Bonded Logic®'s UltraTouch® cotton fiber insulation. In addition to providing maximum health and superior R-value thermal performance, it is Class A fire rated, offers excellent thermal and acoustical properties, and is treated with a non-toxic mold, mildew, and pest inhibitor. The steel-framed stud walls enclosing the Otis Gen2 elevator shaft and the laundry room will further be surfaced with an Acoustiblok® UL (Underwriters Laboratories) assembly designed to soundproof these areas. While Acoustiblok meets over 207 UL wall, ceiling, and floor-assembly codes, it in itself is not, nor claims to be, a fire-proofing method for construction. However, relative to virtually 99 percent of all similar products on the market that might be used in a home and add to the risk of fire, Acoustiblok is the only particular formula that has passed UL's stringent requirements. Therefore, Acoustiblok has earned a Class A one-hour fire rating. Overlaid on top of the Acoustiblok material will be USG Sheetrock™ Firecode® Type C Core gypsum panels. USB Sheetrock possesses superior fire-resistance and heat-transmission properties and is exceptionally resistant to cracks caused by structural, thermal, or hygrometric changes.

The elaborate 2-foot-13/16-inch-thick acoustical wall assemblies to be constructed in the Optimum Performance Home Theatre will be faced with double layers of USG Sheetrock Firecode Type C Core gypsum panels. The rear-projection room will be faced with Quite Solution® QuietRock 530, which is UL Classified fire-rated for one hour. The insulation to be packed into the Owens Corning QuietZone® Acoustical Wall Framing cavities will be fire-resistant Latitude™ natural wool insulation. Wool has a high, natural fire resistance and is virtually non-flammable. The main reason for this is that wool contains moisture in each fiber and resists flame without chemical treatment. Wool has a high Limiting Oxygen Index (LOI=25.2), and this means that oxygen content of 25.2 percent is necessary to completely burn wool, whereas air only contains 21 percent. Thus, wool will tend to char or smolder instead of bursting into flame in the event of a fire. When the flame source is removed, wool will self-extinguish; it will not support combustion. This benefit has lead to the use of wool fabrics as fire-resistance clothing for personnel involved in high-risk fire environments.

The floors of the master bedroom suite, guest bedrooms, living room, and Optimum Performance

Home Theatre and rear-projection room will be covered with Earth Weave Carpet Mills' Broadloom Bio-Floor® sustainable wool carpet—the purest carpet available. Wool's high-moisture content and protein constituents make it naturally flame retardant.

Natures Acoustics' Whisper Wool® material will be the underlay for the Kahrs® hardwood flooring, Natural Cork® flooring, and Bedrosians slate flooring in the home. In tests, Whisper Wool has a Flame Spread Index of 35 and a Smoke Developed Index of 50, both indicating excellent fire mitigation.

An Uponor fire sprinkler system will be employed throughout the home. Designed for fast response, the AQUAPEX® plumbing system will provide water to the sprinkler fixtures, which will activate independently when temperatures reach 150-degrees Fahrenheit. The system exceeds the National Fire Protection Association (NFPA) requirements.

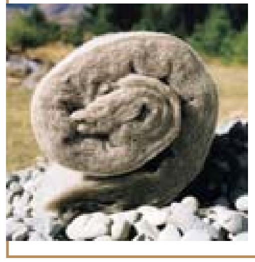
Other Fire Mitigation Treatments

Henkel's OSI GreenSeries™ Flameseal® Flame, Smoke and Draft Stop Sealant will be applied throughout the construction. The product is designed for use in both residential and commercial fire-stopping applications. The sealant was developed to seal service penetrations and joints in Fire Separations and Firewalls, and prevent the passage of flame, smoke, and fumes under actual fire conditions. Also, when applied at penetrations between walls and floors, Flameseal will prevent drafts from room to room and floor to floor during the normal life of the structure which, over the life cycle of the structure Flameseal will help lower heating and cooling costs. Flameseal meets all requirements of a single component fire-stop for gypsum wallboard (drywall/sheetrock) and concrete and concrete block one-, two- and three-hour rated fire separations, and has been fire-resistance-tested as a through penetration fire-stop by Underwriters Laboratories and Warnock Hersey.

No-Burn fire retardants and reactants will be applied throughout the home, including the structure and combustible items within the home. No-Burn, Inc. has developed a highly advanced line of non-toxic, non-carcinogenic liquids that render a vast array of materials incapable of burning as well as inhibiting the growth of toxic-black mold (stachybotrus chartarum). No-Burn formulas are designed to remove the fuel a fire needs to burn and deny mold a food source. Fabric, carpet, and furniture

Latitude™ Insulation

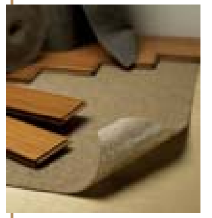
• The natural wool used in Latitude™'s insulation is from wool processing in New Zealand. Wool, unlike synthetic materials, actually reacts to changes in temperature and atmospheric moisture. Insulation made with natural wool fibers not only achieves impressive R-value thermal performance, but because of wool's thermo-regulation properties, wool insulation has the ability to absorb and release water vapor and has been proven through independent laboratory tests to help keep buildings cool in summer and warm in winter.



Earth Weave Carpet Mills, Inc.

• Earth Weave's Broadloom Bio-Floor sustainable carpet is made with 100 percent undyed naturally pigmented wool fibers and yarn with no synthetic glues, no moth proofing, and no stain protections or chemicals of any type, which assures that the carpet will not affect indoor air quality through off-gassing of volatile organic compounds (VOC).

Nature's Acoustics



• Nature's Acoustics Whisper Wool™ is a floor underlay made from 100 percent sheep wool for laminate, engineered, and hardwood floors. It makes laminates sound deeper in tone, duplicating a more wood-like sound. Whisper Wool also prevents sound transmission through floors and walls. It also helps prevent squeaks in hardwood floors, thus making hardwood floors quieter than ever.

Uponor® Fire Protection System

• Uponor®'s reliable and trouble-free fire sprinkler system is designed for fast response. The AQUAPEX® plumbing system provides water to the sprinkler fixtures, which activate independently when temperatures reach 150-degrees Fahrenheit. The system exceeds the National Fire Protection Association (NFPA) requirements.

OSI Sealants, Inc.

• OSI Sealants, Inc. is a leading manufacturer of caulks, sealants, adhesives, and wood-patching products with more than four decades of experience in developing and supplying the highest quality products. The company's Green Series™ features low-VOC construction adhesives, caulks, and sealants.

Bedrosians® Natural Stone Slate Flooring

• Bedrosians® natural slab Autumn Gold slate flooring will be the selected flooring for the entrance, vestibule and walkway connector, interior walkway, solarium, kitchen, and courtyard.

No-Burn®

• No-Burn® fire retardants and reactants, are a highly advanced line of non-toxic, non-carcinogenic liquids that render a vast array of materials incapable of burning, as well as inhibiting the growth of toxic black mold. No-Burn removes the fuel a fire needs to burn when applied to wood, drywall, fabric, carpet, and furniture.

can also become highly flame resistant with the use of No-Burn products. All No-Burn products carry a Class A rating and are designed to reduce the choking, toxic smoke produced by a fire by as much as 80 percent. They have passed a multitude of test standards, including those performed by the National Fire Protection Agency.

In the event that a fire were to occur anywhere in or around the structure, No-Burn provides additional time to exit safely. The application of No-Burn coatings on the Optimum Performance Home will allow the structure to be encapsulated with a non-toxic, non-carcinogenic flame retardant; preventing the home from being fuel in the case of a fire.

Where wood is used on the exterior and interior structure of the Optimum Performance Home, No-Burn Wood Gard Mih will be applied. This is a dual-action product that has proven to be effective against the potential of fires with regard to the preservation of the structural integrity of wooden structures. The product is UL and UL Classified, carries a Class A rating per ASTM E-84, and meets the requirements of UL 723. It has also achieved zero mold growth per ASTM D5590-94.

Paintable surfaces within the home will be treated with No-Burn Plus Mih. This product is a dual-action coating that protects surfaces as a fire reactant while inhibiting the growth of toxic-black mold. No-Burn Plus Mih provides the same fire and mold-resistant protection as Wood Gard Mih, but is suitable for application to the interior surfaces of a structure, such as drywall/sheetrock or anywhere where latex paint can be used. The same UL and ASTM standards apply. No-Burn Plus Mih carries a Class A rating and meets the requirements of UL 723.

No-Burn Fabric Fire Gard effectively slows down the spread of fire and prevents interior furnishings from catching fire. Fabric Fire Gard is a clear and odorless liquid that is non-toxic, non-carcinogenic, and an environmentally safe fire retardant. It will be applied to furniture fabrics (leather excluded) and other interior furnishings, such as bedding and mattresses, drapes, curtains, tablecloths. No-Burn Fabric Fire Gard has received a Class A fire rating per ASTM E-84 and meets the requirements of NFPA 701.

Finally, No-Burn Original will be applied to furniture, wood furniture, wood cabinets, and other wooden ornamental surfaces (prior to finishing). No-Burn Original is odorless, non-toxic, non-carcinogenic and will not leave a residue. It carries a Class A fire rating and meets the requirements of UL 723.

Property insurance coverage in certain states can be reduced by up to 15 percent when No-Burn products are specified during the construction of a new home. Furthermore, a new home built with No-Burn products may receive a .5-percent mortgage rate reduction. No-Burn provides a seven-year Builder Mold Warranty, which covers the home builder for all areas treated with No-Burn Mih up to $50,000 in mold remediation-related costs.

Finally, as part of the training conducted by the Community Emergency Response Team (CERT) at The Sea Ranch, an evacuation response will be rehearsed and documented throughout the home. A well-equipped emergency kit will be located in each building of the compound with instructions for use and what items to take and put into the evacuation vehicle, should evacuation be necessary. Other emergency lists will be provided at key locations within the home providing instructions for preparing the indoors and outdoors if a wildfire should occur and endanger the home and its occupants.

Next

Now that Sonoma County Building Department has completed its review of the building plans and all permits have been issued, this continuing series of articles will focus on the design elements as they pertain to each stage of construction, and include coverage of the technologies and building systems, and the materials used and applied to construct the first Optimum Performance Home. UHD

The Author

Gary Reber is the President of Ultimate Home Design, Inc. and the founding Editor-In-Chief and Publisher of *Ultimate Home Design*®, The Optimum Performance Design & Build Resource For Environmentally Enhanced Lifestyle Living™. He is also President of WSR Publishing, Inc, which publishes *Widescreen Review*®, The Essential Home Theatre Resource™. His diverse background in several fields includes an undergraduate, graduate, and postgraduate university education in architecture, community planning, and economic development planning. For years he was a consultant on community and economic development planning. For the past 15 years he has been an editor and publisher of magazines in the consumer electronics field. Gary can be reached at 951 676 4914 or gary@ultimatehome-design.com.

Product Information

• Acoustiblok, 4216 East Busch Boulevard, Tampa, Florida 33617, 813 980 1400, www.acoustiblok.com
• Amvic, Inc. 501 McNicoll Avenue, Toronto, Ontario, Canada M2H 2E2, 877 470 9991, www.amvicsystem.com
• Amvic Pacific, Inc. 12531 Lowhills Road, Nevada City, Nevada, 95959, 530 265 9085, www.amvicsystem.com
• Artistic Doors And Windows, 10 South Inman Avenue, Avenel, New Jersey, 07011, 800 278 3667, www.artisticdoorsandwindows.com
• Ashland, Inc., 5200 Blazer Parkway. Dublin, Ohio 43017, 614 790 3818, www.ashland.com
• Bedrosians, 4285 North Golden State Boulevard, Fresno, California 93722, 559 275 5000, www.bedrosians.com
• Carriage House Door. 1421 Richards Boulevard, Sacramento, California 95814, 916 375 0575, www.carriagedoor.com
• Copper Craft, 4995 Keller Haslet Road, Keller, Texas 76248, 817 490 9622, www.coppercraft.com
• Dimension One Spas, 2611 Business Park Drive, Vista, California 92081, 800 345 7727, www.d1spas.com
• DrewFoam, Inc., 144 Industrial Drive, Monticello, Arkansas 71655, 870 367 6245, www.drewfoam.com
• EarthSource Forestry Products, 1618 28th Street, Oakland, California 9460, 510 208 7257, www.earthsourcewood.com
• Earth Weave Carpet Mills, Inc., P.O. Box 6120, Dalton, Georgia 30722, 706 278 8200, www.earthweave.com
• Evergreen Slate Company, Inc., 68 East Potter Avenue, Granville, New York 12832, 518 642 2530, www.evergreenslate.com
•Finnleo Sauna & Steam, 575 East Cokato Street, Cokato, Minnesota 55321, 800 346 6536, www.finnleo.com
• Gutter Helmet/Southeastern Metals (SEMCO), 11801 Industry Drive, Jacksonville, Florida 32218, 904 757 4200, www.gutterhelmet.com
• Holzkraft Industries, LLC, 28206 Commercial Avenue, Barinton, Illinois 60010, 847 381 7670, www.holzkraft.com
• Industrial Acoustics Corporation (IAC), 1160 Commerce Avenue, Bronx, New York 10462, 718 931 8000, www.industrialacoustics.com
• Kährs, 940 Centre Circle, Suite 1000, Altamonte Springs, Florida 32714, 407 260 9910, www.kahrs.com
• Latitude/Live Edge, LLC @ Joinery Structures, 2500 Kirkman Street, Oakland, California 94607, 510 451 6345, www.latitudeinsulation.com
• Lindal SunRooms/Cedar Homes, P.O. Box 24426, Seattle, Washington 98124, 206 725 0900, www.lindal.com
• MaxiTile, Inc., 849 East Sandhill Avenue, Carson, California 90746, 800 338 8453, www.maxitile.com
• Natural Cork, 150 Connector 3, Dalton, Georgia 30720, 800 250 6690, www.naturalcork.com
• Nature's Acoustics, 80 Old East Road, Chatsworth, Georgia 30705, 706 422 8660, www.naturesacoustics.com
• No-Burn, 1392 High Street, Suite 211, Wadsworth, Ohio 44281, 330 336 1500, www.noburn.com
• Nordic Structures, LLC, 536 Alcoa Circle, Corona, California 92880, 951 493 7770, www.nordicstructures.com
• OSI Sealants, Inc./Henkel Corporation, 32150 Just Imagine Drive, Avon, Ohio 44011-1355, 800 321 3578, www.osisealants.com
• Owens Corning, One Owens Corning Parkway, Toledo, Ohio 43659, 419 248 8000 / 2790 Columbus Road, Route 16, Granville, Ohio 43023-1200, 800 GET PINK (800 438 7465), www.owenscorning.com
• Otis Elevator Company, 10 Farm Springs Road, Farmington, Connecticut 06032, 860 676.6000, www.otiselevator.com
• PacWind, Inc., 23930 Madison Street, Torrance, California 90505, 310 375 9952, www.pacwind.net
• Pella Corporation, 102 Main Street, Pella, Iowa 50219, 641 621 1000, www.pella.com
• PEARL Protected, 730 Peachtree Street, NE, Suite 850, Atlanta, Georgia 30308, 800 374 5737, www.pearlprotected.com
Quite Solution, 1250 Elko Drive, Sunnyvale, California 94089, 408 541 8000, www.quietsolution.com
• Revere Copper Products, Inc., One Revere Park, Rome, New York 13440-5561, 800 448 1776, www.reverecopper.com
• ThermaSAVE/IHSN, Inc, 2470 County Road, Florence, Alabama 35633, 256 766 3378, www.thermapanel.net
• TrendSetter Industries, Inc., 818 Broadway, Eureka, California 95501, 800 492 9276, www.trendsetterindustries.com
• United States Gypsum Company/USG Products, 125 South Franklin Street, Chicago, Illinois 60606, 800 874 4968, www.usg.com
• Uponor North America, 5925 148th Street West, Apple Valley, Minnesota 55124, 952 997 5329, www.uponor-usa.com
• VELUX America, Inc., 104 Ben Casey Drive, Fort Mill, South Carolina 29708, 888 838 3589, www.VELUX.com
• WaterFurnace International, Inc., 9000 Conservation Way, Fort Wayne, Indiana 46809, 800 222 5667, www.waterfurnace.com

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More Than Just A Hurricane Proof House

ASHEVILLE, NC—With energy costs rising to astronomical levels, homeowners are looking for any way possible to save money. North Carolina-based Deltec Homes, with their unique home design, has the answer.

Deltec specializes in building round homes, which tests have proven to be about twice as energy efficient as the conventional square or rectangular house. Circular structures require less exterior walls to enclose the living area. This allows for less energy to escape from the house. The aerodynamic nature of the circular design also helps reduce drafts throughout the home, which is one of the biggest reasons for increased energy use. "Some of the same qualities that make our homes so wind resistant also contribute to their high degree of energy efficiency," said Joseph Schlenk, Director of Sales and Marketing for Deltec Homes.

"Our design takes the round, energy-efficient design a step further," Schlenk said. "One example of this is the roof venting system, which is unique to Deltec's design."

The roof design contributes to lower energy use by allowing constant airflow throughout the year. The continuous airflow keeps hot air out of the attic in the summer, reducing the need to cool the house at the level a conventional home requires. The roof system also prevents snow and ice from building up on the roof in the winter, which further reduces heating costs.

The Deltec roof also has an overhang, which keeps out solar energy from the high summer sun and allows solar energy in during the winter when the sun is at a lower angle.

"One of the reasons why we are such believers in the Deltec system is that we used to live in a house that was approximately 1,300 square feet. Our electric bills ranged from $120 to $250 a month," Kim, a Deltec homeowner from Magnolia, Texas, said. "Our Deltec home is almost 4,000 square feet (around three times the size of our old house) and our electric bill averages around $120 to $130 per month. The Deltec home is the best construction you can find."

In addition to the effective design of the homes, the construction method Deltec uses when building homes also contributes to energy conservation. Homes are constructed panel by panel and then shipped off to the building site. Each panel is constructed so they fit together so precisely that air drafts are limited.

"We're real good at making sure that happens," Schlenk added. "We ship homes all over the world so we have to be sure the pieces fit together perfectly."

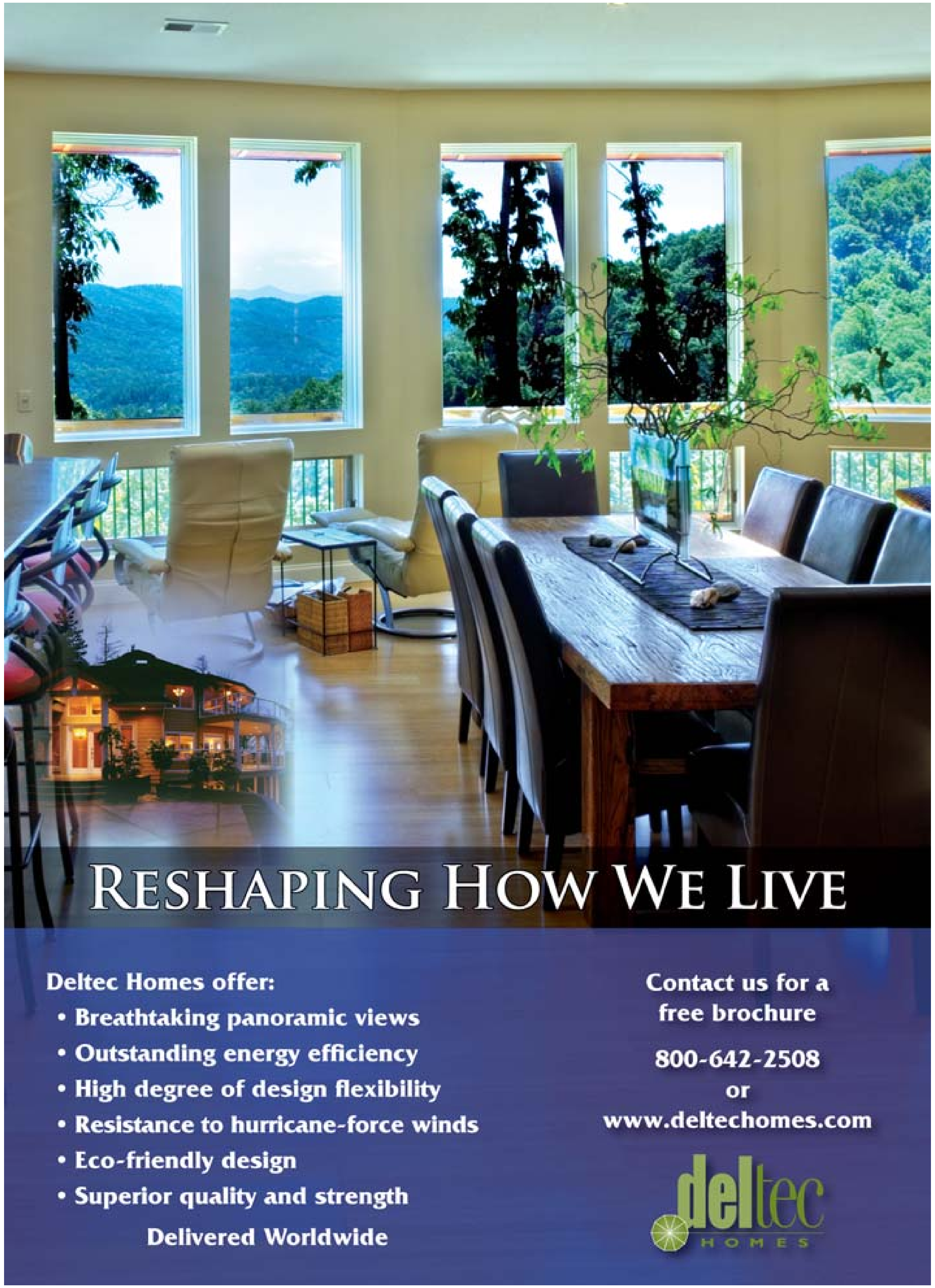
In addition to being a huge energy cost saver, Deltec homes provide numerous other benefits. Among the more important ones is the ability to withstand hurricane-level winds.

As storms battered homes in 2005, Deltec-built houses were able to fight off the winds and survive with no structural damage.

"After Hurricane Katrina we contacted all of our homeowners that were in her path," Schlenk said. "None of the homes suffered any structural damage. Any damage was limited to either minor cosmetic damage or a few missing roof shingles."

Besides the functional features that make these homes so appealing to homeowners, the houses also have an unmatched visual appeal. The unique design and flexible floor plans allow owners to build their dream home. The plentiful windows frame the spectacular views whether the house is in the mountains or on the water.

"Our design allows the homeowner to customize their home, including having windows where they want," Schlenk said. "There are not many designs that can capture a view the way a Deltec home can. When you consider all of the benefits that our design offers-high wind resistance, energy efficiency, design flexibility and overall quality, and high curb appeal-we feel that we can offer our customers the perfect home."



Every Home Is A Solar Home

Terence Parker

synopsis

- Solar energy makes economic sense when the cost of the equipment and installation of a solar-energy system is compared with the equipment and installation cost of a power line from the utility company.
- Solar panels that are integrated into the building envelope in some way can result in a PV array that does not distract from the architectural lines of the building and lower installed cost.
- As long as the sun is up (even during a light rain or cloudy weather), the system will produce electricity that can be used by any appliances operating during the day, and when the system produces more electricity than the home can use during the day, your electricity meter will spin "backwards" accumulating "retail-rate energy credits" for later use.

Introduction

"Solar Power? I thought that stuff was for satellites in space and it wasn't ready for houses here on earth!"

"Solar Power? It's OK for calculators and arrow signs on the freeway, but it can't produce enough power to run a regular house!"

"Solar Power? I have nothing against it but I think it's too expensive right now. Maybe I'll take a look at it in the future."

These are typical reactions from people who were asked about solar power and its applications for homes. These impressions were born out of an earlier industry that has been changing steadily since the 1970s. At that time, most solar-power systems were employed on satellites, and in special situations where a small solar-energy system made more sense than stringing a power line out to some small electrical load, like a police call box or remote hunting lodge.

Today, every home is a solar home. The sun beats down daily producing nothing more than wasted energy. It just makes sense to capitalize this waste into productive value, using one or more technologies. The first technology, called solar thermal technologies, uses the heat energy of the sun to warm water or air in solar thermal collectors. This thermal energy is used to preheat the water or air that is typically provided by

standard hot water heaters or forced-air systems. The second type, called solar electric technologies, or photovoltaics (i.e. PV), uses the visible light spectrum coming from the sun to stimulate the PV panels to generate electricity. This electricity can be wired to any electric appliance via the solar-energy system. This article will focus on solar electric, or PV, technologies.

As the price of PV panels started to drop in the '70s and '80s, homesteaders in remote areas of the country were beginning to build solar systems for their remote homes. This activity continues today as the price of PV panels (and the other equipment that goes along with the PV panels) drops. Police call boxes, arrow signs on the nation's freeways, security cameras and sensors, bus shelters, remote homes, telecommunications, and aviation needs are all being serviced by modern solar-energy systems. In all these cases, solar energy makes economic sense when the cost of the equipment and installation of a solar-energy system is compared with the equipment and installation cost of a power line from the utility company.

As we entered the 1990s, strong government programs supporting the installation and use of solar-energy systems in Japan spurred PV panel manufacturers to increase production. In the mid 1990s, the German government implemented a similar solar-energy incentive program. The strong demand for PV systems from both Japanese and German consumers forced greater increases in worldwide PV manufacturing capacity, and the price of the PV panels dropped even further. By 2006, worldwide manufacturing capacity increased to almost 2 gigawatts, and today we are seeing steadily decreasing retail prices in the PV marketplace. You add this to all the new rebate and incentive programs sprouting up in Italy, Spain, Greece, and the United States, and you end up with an industry that is growing by more than 35 percent per year. Growth in the U.S. is supported by the government, which is currently offering at least $2,000 dollars per home as an incentive to install a PV system. Also, many states in the U.S. have their own incentive and/or rebate programs that can further reduce the installed cost of a PV system (check out www.dsireusa.org for details about rebates and incentives in your state). In addition to these state and federal programs, the U.S. government has implemented the Solar America Initiative that has the goal of reducing the cost of installed PV systems to a point where these systems can compete directly with utility retail pricing by 2015.

United Solar Ovonic

United Solar Ovonic is a wholly owned subsidiary of Energy Conversion Devices (ECD). ECD is traded on the NASDAQ under the symbol ENER. ECD and United Solar Ovonic have been producing PV panels since 1983.

Intellectual property and long-term experience in high-volume production of PV panels are two great assets for the company. United Solar specializes in thin-film PV panels. The technology that we have developed is called amorphous silicon photovoltaics. We have also developed the manufacturing systems and machines to produce amorphous silicon solar cells and solar panels. Today, we have manufacturing facilities in the U.S., Mexico, and around the world (e.g. U.S., Mexico, China). United Solar offers a full line of PV panels for applications ranging from small battery charging to utility scale megawatt-generating facilities. We also offer PV system design and engineering consultation, user interface and data acquisition systems, and business-to-business consultation on solar cell manufacturing, solar panel assembly, and the use of solar energy for backup power, utility bill reduction, greenhouse gas reduction, etc.

In 2007, United Solar developed a new product for the residential market. High-quality components have been assembled in a pre-engineered package called the UNI-SOLAR® Integrated Residential PV System. This kit was designed at United Solar, where a team of electrical engineers and roofing-system engineers, with over 90 years of collective experience in the solar energy business, were able to optimize every part, review all the installation techniques, and finally come up with a complete package that will install quickly and perform safely and reliably in your home for years to come. This will be introduced to the market very soon.

There are distinct advantages to purchasing a solar-energy system developed by United Solar. For example, our non-glass modules perform reliably year after year, absorbing any punishment Mother Nature can dish out—severe hail, large branches or other debris being blown onto the array, stones or rocks hurled onto the roof, etc. The UNI-SOLAR engineers have tested these PV systems under rigorous laboratory test

conditions and extreme outdoor conditions to ensure that they are ready for your home, wherever it may be located. Additionally, as the designer and manufacturer of the complete PV system, the system warranty and component warranties are backed by United Solar Ovonic. In addition to the real, tangible environmental benefits to ownership of a UNI-SOLAR Integrated Residential PV System, these systems are eligible for state- or federally-sponsored rebate and buy-down programs. Since United Solar amorphous silicon PV modules provide more kilowatt-hours-per-installed-kilowatt compared to any other PV technology, homeowners can be assured they are getting the best value for their money.

A Residential Solar Electric System Featuring Building-Integrated Solar Panels

"Building integrated" is a new buzzword in the PV industry. It refers to solar panels that are integrated into the building envelope in some way. Although integration of the PV panels into the building can result in a PV array that does not distract from the architectural lines of the building, the real promise of building-integrated PV (i.e. BIPV) is lower installed cost. This is accomplished by leveraging the labor that is employed to install the building envelope (roof and walls). By incorporating the PV panel into the roof or wall materials so that the PV panel does not change the installation timing or procedures, the solar array will already be installed by the time the electrician comes to install the rest of the PV system components.

In the '70s and '80s it was acceptable, almost a badge of honor, to have a big mono block of PV panels on the roof. However, architects and designers did not appreciate the "environmental beauty" of the PV panels but instead saw the PV array as distracting and not very attractive. Design of the array became more important, and every PV manufacturer today is making an effort to make the solar array more attractive. The United Solar Integrated Residential PV system utilizes a building-integrated PV panel that is built into the roof and provides both power for the home and protection for the roof. The building-integrated solar panels act just like typical residential roofing products, providing a watertight, water-shedding roofing system. Roofers install these panels so that there is warranty clarity for the homeowner. There is nothing worse than having your roofer tell you that the roof penetrations you made to mount the PV module support rack violate their watertightness warranty. When the roofer installs building-integrated solar panels, the homeowner can be assured that the roofer will stand behind his standard watertightness warranty.

Knowing that your roof warranty is in place, with no room for controversy, is comforting to the homeowner. Assurance that your hard-earned dollars are being spent on the right things for your home can also bring peace of mind. Energy efficiency is where you should start before considering active solar systems that generate electricity for your home. Consider passive solar designs, well-designed windows and doors, and properly insulated and ventilated walls, ceilings, and attic spaces. Money spent on these strategies can save the homeowner substantial dollars and many of these technologies will pay back the homeowner within three years.

It has been shown that money spent on energy-efficiency strategies brings down the overall net investment in the home. Energy technologies interact, often proving that the sum of the parts is higher in cost and energy intensity than the same parts downsized for integration. For example, energy-efficient lighting reduces heat output, which reduces the size of the air-conditioning equipment, allowing for more expensive yet more energy-efficient HVAC systems. Building-integrated solar roof systems like the UNI-SOLAR Integrated Solar Roofing System, save roofing costs and increase insulation from the sun and elements, reducing HVAC loads, and combined with energy-efficient lighting, lower solar system requirements, hence improve system-wide economics.

Solar System Components

The solar modules used in this system are the Integrated UNI-SOLAR PV Roofing Panels. The modules are UL Listed, both as an electricity generator and as a prepared roofing cover. The solar panel interconnection wire supplied with this system is designed for exterior applications and is tolerant of wide temperature extremes. The wires and conduit for the run from the rooftop solar panels to the solar electric equipment in

the house are normally supplied by the local electrician (i.e. the PV system integrator). The Solar (DC) Disconnect Switch provides a way to break the connection between your building-integrated PV panels and the inverter. The Switch can be operated anytime, day or night. The switch is contained within a tough plastic or metal box that can be mounted indoors or outdoors. The box cannot be opened unless the switch is in the OFF position. The switch enclosure also acts as a "combiner box" for individual parts of the solar array. Each part of the solar array is fused for safety. The inverter mounts on the wall and is very quiet during operation. It should be mounted so that the display is easily viewed and that there is adequate room around the inverter so that it can be accessed in an emergency and has enough space around it to vent away any heat that the inverter makes during operation. The inverter is connected directly to the AC breaker box via a standard AC breaker, allowing the inverter to "sell" 2,000 watts of power back to the grid. This connection to the utility lines via the AC Breaker Box in your home is allowed under Net Metering Laws in your state. Again, you can check the Web site (www.dsireusa.org) for details.

System Components

United Solar is in the building-integrated PV business. By installing solar panels that are also roofing products, homeowners get a "material credit." In other words, their overall material costs will be lower because United Solar's solar panels are replacing traditional building materials and do not require a PV panel support structure beyond the building itself.

Homeowners will also see a "labor credit" by purchasing UNI-SOLAR building-integrated products. The fact that the System is pre-engineered greatly reduces engineering and planning time for the installation company. Roofing companies will be installing the solar panels in the same way they install standard roofing materials, so the re-roof job includes the installation of the solar array. Wiring time and mechanical-installation time are improved because of the fully integrated design of the system that includes quick-connect terminals on the modules, color-coordinated wires and wiring, clear instructions for both the roofers and electricians, and lightweight components with well-designed packaging, etc.

Overview Of The Installation Of The Residential PV System

Homeowners will receive their Integrated Residential PV System in a number of boxes. These boxes will contain all the system components including the PV roofing panels, solar array interconnection wires, a Solar (DC) Disconnect Switch, a 2,000-watt inverter, a junction box for the solar array, grounding equipment, and labels. The electrician (i.e. PV system installer) will need to supply rigid (metallic) conduit and conduit fittings for the wire run from the rooftop array to the inverter inside the home. He will also need to provide various fasteners and other pieces to attach the electrical components to the walls inside the home.

System Performance Advantages

Installation of a UNI-SOLAR Integrated Residential PV System will reduce your electricity bills from the very first day that the system is installed. All electricity (every watt) that is produced by the PV system will be used by the home or building. The PV system is never "sitting idle" while the sun is up. As long as the sun is up (even during a light rain or cloudy weather), the system will produce electricity that can be used by any appliances operating during the day. If the PV system is producing more electricity than the home or building can use during the day, all these extra watts will be drawn out of the house and onto the Utility Grid Power Lines. This will cause your electricity meter to spin "backwards," in essence, accumulating "retail-rate energy credits" that can be used later (e.g. on a rainy day or at night).

The solar modules used with the PV system are especially designed for the hot temperatures typically seen on roof surfaces. UNI-SOLAR modules perform at their peak efficiency during warm weather (when the solar panel is hot). All UNI-SOLAR modules will perform up to their specifications, even

with rooftop temperatures approaching 190 degrees Fahrenheit! Back venting the UNI-SOLAR modules, to keep them as cool as possible, is not necessary as the UNI-SOLAR module performs better as ambient (and cell) temperatures rise. This reduces material and labor costs associated with a module support rack that suspends the solar modules above the roof surface.

UNI-SOLAR modules have excellent relative performance under cloudy or low-light conditions. The light spectrum-splitting capability of the UNI-SOLAR Triple Junction solar cell ensures excellent relative performance (compared to the competition) when the solar spectrum is shifted towards the blue (e.g. during the summer or during cloudy weather). Although UNI-SOLAR modules could be scratched if hard-sole shoes or sharp objects are dragged across the module, the area where UNI-SOLAR modules are bonded to the roof is still a usable and "walkable" space. The modules lay flat to the roof and all wiring is hidden away. Modules can be carefully walked or kneeled on during and after installation.

After Your United Solar Integrated Residential PV System Is Installed

After your PV system is installed, a UNI-SOLAR Area Manager, or his or her designer, will visit your home or building to inspect the installation. He or she will go through a checklist to ensure that all work was completed and done properly. The system will be inspected for:

1) any problems with the equipment
2) any issues with the roof or any of the wiring
3) any issues related to the connection between the UNI-SOLAR PVB system and the electrical service in your building
4) any issues related to the local Building Codes and National Electric Code

After your inspection is complete, the UNI-SOLAR Area Manager inspects your system, and you can be assured that the PV system is safe to turn on and operate.

Case Study
Searching For The Right Solar Energy System

When a pair of filmmakers from New York City went looking for a solar system to power their new home, they found just one that met every requirement.

Escape From New York

Campbell Daiglish and Catherine Oberg wanted to escape their Manhattan apartment. And when they found a wooded lot in East Patchogue, Long Island near wetlands, a lake, and bordering on a bird sanctuary—they fell in love.

Early on, Campbell and Catherine decided their home would feature solar technology. "Solar is really catching on," said Campbell. "But most people are conservative about the look of their homes. When you mention solar, they picture unsightly panels that are snuffed out by a passing cloud. We wanted to show that solar has come a long way."

Form And Function

Campbell and Catherine set three criteria for the solar-energy system they would choose. It had to be effective. It had to be attractive. And, it had to be affordable.

They were also determined to have minimal environmental impact. "We didn't want to cut down any extra trees." But time and again, they were told they'd have to cut down trees to ensure sufficient sunshine reached the solar panels.

However, there was one exception: The UNI-SOLAR® system from United Solar Ovonic. "When they told us the installation wouldn't require the felling of a single tree, it made our decision very easy."

Saving Money, Saving Trees, Saving Energy

UNI-SOLAR systems also met the rest of their requirements. Once installed, the system was almost indistinguishable from the standing seam metal roof. "The panels become part of the roof. It's a beautiful installation. People can't believe it's a solar-power system."

Most importantly, United Solar Ovonic's unique systems generate efficient power when the shade from all those still-standing trees obscures a large portion of the roof. On days when the home uses little electricity, the extra power generated by UNI-SOLAR will be sold back to Long Island Power Authority, turning the electric meter backwards.

Campbell and Catherine went into the project as advocates of solar power and came out as fans of UNI-SOLAR systems. "We absolutely believe we got the best system." UHD

Interconnection Agreements With The Utility And New Meter Installation

After your PV system is installed, you must call the utility company and get an Interconnection Agreement from them. This agreement ensures that the utility company knows you have a PV system wired to the electrical grid, and it gives the utility an opportunity to perform an anti-islanding test on your system. "Islanding" is a condition that occurs when the utility power is cut and your solar system starts to feed power onto the utility power lines, forming a small "island" of electrical service for you and surrounding homes or buildings. This is a dangerous situation for a utility line worker who thinks the power lines are de-energized. An anti-islanding test involves shutting down the main AC breaker in your home or building (simulating a cut in the utility service) and then testing how fast your inverter shuts down. Normally the inverter will shut down in less than one second, and the anti-islanding test will confirm this.

After the anti-islanding test is complete, an agreement with the utility will be signed and a separate form may need to be filled out if a new meter is required at your site. A meter that is used with a "Line-Tie" solar energy system must be able to record both incoming and outgoing electricity.

Commissioning (Turning ON) Your UNI-SOLAR PV System

After the PV system has been inspected, and the Area Manager has inspected the system and given you a signed copy of the inspection checklist, you can turn on your system. Instructions for turning on the United Solar Residential PV System are detailed in the Operation Instructions.

System Operation

Your PV system will operate without any intervention from you. The solar modules do not require maintenance. The inverter can protect itself from voltage spikes or brownouts in the electrical service. Additionally, the inverter will shut down every night (all the LEDs will turn OFF) and then turn back on in the morning. The inverter will disconnect from the utility power lines automatically if there is a problem and then automatically reconnect when the problem goes away.

All you have to do is make sure the inverter is clear of obstructions so that the inverter heat sink can effectively disperse the heat generated by the internal parts. You should also make sure that the path to the disconnect switches, and the area in front of the disconnect switches, is clear. You have to imagine that a fireman has rushed into your house (God forbid!) and wants to shut off the electrical service. You need to make sure that he can do his job and will not be tripping over anything left on the floor or leaning against the equipment.

The Solar Modules On The Roof

The solar modules on your roof do not require any maintenance. You may notice that, after a particularly heavy pollen season, a film has been deposited on the surface of the modules. You may also see an extra-heavy film on your modules if you live near a smokestack or near the airport. If this is the case, a common garden hose can be used to spray the modules and rinse them of the extra dirt build-up. Normally you will see some dust and dirt on the modules, and it is anticipated that your system will lose about two to three percent of its potential power due to dirt and dust on the solar modules. Normal rainfall will ensure that you do not lose any more than three percent, and a heavy rainfall or snowfall will clean your modules completely.

The Electrical Equipment Mounted On The Wall In Your Home Or Building

There are three important electrical boxes associated with your PV System. First, there is the Solar Junction Box. This box should never need to be opened. It is the transition point between wires coming from your solar modules to the wires run in conduit routed toward your Solar Disconnect Switch and inverter. The second box is the Solar (DC) Disconnect Switch. This box contains fuses, and if there is a system fault, the switch on the front can be moved to the OFF position, the box can be opened, and the fuses can be pulled out and checked. The Solar (DC) Disconnect Switch box should only be opened at night (when the solar modules are not producing electricity) and the inverter has been shut down. The third box is the inverter itself. Its operation is fully automatic.

The Connection Between The PV System And The AC Breaker Panel In Your Home Or Building

Your PV System is connected to your home or building by connecting the output of the inverter to a circuit breaker in the AC Breaker Panel. The circuit breaker in your AC breaker panel must be well labeled and clamped down inside the AC breaker panel. The cover on the panel will be adequate to clamp down the breaker in most cases. In order for the inverter to operate, it must be connected to the utility power lines, and this means that the inverter will not operate until the breaker is in the ON position. There is no maintenance required for this part of the system.

Once or twice a year, the homeowner must:

- Check the Solar (DC) Disconnect Switch door and the faceplate on front of the inverter to ensure that they are completely closed and all screws are tight
- Check to see that there is adequate clearance (8 inches on all sides) around the heat sink mounted on top of the inverter
- Check to see that the Solar (DC) Disconnect Switch and inverter are not exposed to excessive dust or vibration
- Check all conduit connections to the Solar (DC) Disconnect Switch and inverter and make sure they are tight
- Check the hardware holding the mounting plate to the wall. Make sure this hardware is tight and that there is no chance that the mounting plate (with the Solar DC Disconnect Switch and inverter on it) will fall off the wall.

The display on the front of the inverter can show a number of things, which are outlined in the manual. If you see a yellow light or red light on the inverter, you can check your manual and look at the display to see if there is anything wrong. If you see a yellow or red light on the inverter, wait one day before reporting it. Although it is possible for the homeowner to repair a fault in the solar system, it is best to call an electrician to fix any problems. After the problem is fixed, the inverter has to be manually restarted. This procedure is detailed in the inverter manual.

Conclusions

There are distinct advantages to purchasing a solar-energy system developed by United Solar. The non-glass modules perform reliably year after year, absorbing any punishment Mother Nature can dish out. PV systems have been tested under rigorous laboratory test conditions and extreme outdoor weather to ensure that these systems are ready for your home, wherever it may be located. As the designer and manufacturer of the complete PV system, United Solar backs the system warranty and component warranties. In addition to the real, tangible environmental benefits to owning a UNI-SOLAR residential PV system, these systems are eligible for state- or federally-sponsored rebate and buy-down programs. Since United Solar amorphous silicon PV modules provide more kilowatt-hours-per-installed-kilowatt compared to any other PV technology, homeowners can be assured they are getting the best value for their money. UHD

The Author

Terence Parker is the Applications Market Manager at United Solar Ovonic. Mr. Parker is principally responsible for product application business case development, product applications design, engineering, testing, pricing assessment, and commercial product implementation. He is the technical resource for the current commercialized UNI-SOLAR product base, offering consultation and design assistance for United Solar Ovonic customers worldwide.

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Residential Energy Management

Aligning Consumers, Utilities, And The Environment To Enable The Smart Grid

Betsy Cragon

Introduction

GridPoint® provides an intelligent energy-management solution that aligns the interests of consumers, electric utilities, and the environment to enable the Smart Grid.

For homes and businesses, GridPoint is enhancing the capabilities and value of residential solar systems by adding battery backup power, real-time monitoring, and online energy-management capabilities, in an all-in-one sleek, energy-management appliance.

For utilities, a network of GridPoint appliances enables utilities to balance demand and supply in an economical, scalable, and environmentally beneficial way. Utilities efficiently manage peak periods by controlling customers' non-essential loads and dispatching power into the electric grid.

In addition, GridPoint appliances provide builders with the opportunity to differentiate their homes, meet the growing demand for solar and wind energy technologies, and create a new revenue stream.

Renewable Energy Integration Made Easy

The award-winning GridPoint Connect™ is the first intelligent energy-management appliance to easily integrate renewable energy sources with remote-monitoring capabilities while providing clean, instant, and reliable battery backup power. GridPoint Connect makes it easy for homes and businesses to integrate renewable energy sources and sell excess power to the utility, thus reducing energy costs.

GridPoint's "plug-and-play" design replaces the traditionally complex custom installations of the balance of system required for renewable energy installations. It acts as an intelligent hub connecting homes or businesses to a renewable energy source, backup power, electric grid, and online energy-management tools. Additionally, GridPoint Connect qualifies for federal tax credits, allowing homeowners and businesses to claim up to 30 percent of the cost of the solar system, in addition to state and local incentives.

GridPoint Connect is featured in the BASF Near-Zero Energy Home in Paterson, New Jersey—one of a handful of residences in the United States to receive the definitive credential in the green building industry—which received a Platinum score from the U.S. Green Building Council's Leadership in Energy and Environmental Design for Homes' (USGBC LEED® for Homes) rating system. GridPoint Connect is also used in *Ultimate Home Design*'s Optimum Performance Home™, soon to become LEED for Homes certified.

GridPoint Connect's standard solar input capacity is 4 kilowatts (kW), but GridPoint can add capacity for homeowners with larger systems. Unlike many solar systems, GridPoint Connect's battery backup feature keeps the power on when it is needed most. With 10-kilowatt hours (kWh) of battery backup power and a 30-amp capacity in backup mode, GridPoint Connect alleviates the frustrations of a power outage. The appliance harvests energy from a residential or commercial solar array, or wind turbine, even when the electric grid fails. Customers can enjoy the benefits of increased battery longevity supplemented by the sun, as well as enjoy hours—or even days—of clean, instant backup power.

For homeowners not utilizing renewable energy, the award-winning GridPoint Protect™ provides the same benefits of clean, instant backup power and online energy management, minus solar or wind integration.

Clean Backup Power

Both appliances automatically provide clean, instant, and reliable backup power to protect homes and businesses from blackouts, brownouts, and power sags for critical loads.

Consumers who experience frequent but brief power outages may wish to back up as many loads as possible to continue living and working with minimal interruption. Consumers who experience longer outages may wish to restrict the number of loads to back up "critical" power needs, such as the refrigerator or sump pump, in order to maximize the duration of backup power protection.

Before installation, consumers should consider which loads to back up in order to optimize power outage protection in terms of capacity and duration. When choosing which circuits to protect, it is useful to understand how much power is required for different appliances in the home or business. The GridPoint installer will work with homeowners and businesses to maximize backup power protection based on their individual needs.

Lights, refrigeration, home offices, kitchen appliances, security systems, sump and well pumps, and communication systems are the most commonly selected secure loads. Some installers also suggest designating a few easily accessible electrical outlets as secure loads to use portable equipment such as lights, radios, ventilators, chargers, power tools, and other small appliances.

During installation, the consumer's desired loads are assigned to dedicated circuits on a secondary load panel—the secure load sub-panel—to draw power from the batteries in the event of a power outage. The duration of actual protection is directly impacted by a consumer's energy consumption during an outage. Limiting the number of loads and using highly efficient appliances will greatly increase the duration of backup power. Furthermore, the backup batteries in a GridPoint appliance draw power only as it is needed. Through GridPoint's online energy-management portal, consumers can adjust energy usage during the power outage.

GridPoint appliances have a 60-amp pass-through capacity and a 30-amp capacity in "backup mode." Therefore, in the event of a power outage, a GridPoint appliance will provide up to 30 amps of backup power to the secure load sub-panel with a surge capacity of 70 amps. The maximum continuous operating power is 3.6 kVA, and the appliance has 10 kilowatt-hours (kWh) of battery storage—meaning it will support a 1-kW load for around 10 hours.

GridPoint Connect customers have the ability to integrate a

renewable energy source to increase battery longevity during a sustained grid failure. During a power grid outage, renewable energy systems connected to GridPoint Connect will continue to provide electricity and recharge the batteries during a power outage, so, in addition to the 10 kWh of stored energy in the batteries, customers will continue to have a steady lifeline of power equal to the amount of energy received from the renewable energy source. In the event there is no solar or wind power production available, the product will charge the battery when grid power resumes.

Unlike traditional backup power systems that release harmful emissions and require outdoor installation, GridPoint appliances are a clean technology designed for safe, indoor installation. Customers can feel good about installing backup power without the safety and environmental concerns associated with fuel-based systems. Additionally, home and business owners faced with outdoor space constraints and community or building codes can now enjoy safe, clean backup power for the first time.

GridPoint's "plug-and-play" appliances seamlessly combine power electronics, high-capacity battery storage, and an advanced computer system. Backed by a comprehensive warranty and in compliance with Underwriters Laboratories (UL) safety standards, the appliance actively communicates with the GridPoint Operations Center to ensure optimal performance. Each GridPoint appliance is programmed to perform a secure data transfer to the GridPoint Operations Center and will report any maintenance need to GridPoint's customer service department. Customers gain confidence and peace of mind that backup power will be available in the event of an outage.

Online Energy Management

Both GridPoint Connect and GridPoint Protect customers have access to GridPoint Central™, the first online

energy-management tool to provide consumers with unparalleled visibility and control over their energy consumption and costs. The portal is as easy to use as online banking. With a few clicks, homeowners can create a personal energy profile to automatically optimize energy usage based on consumption patterns and utility rate schedules. User-friendly, graphical interfaces empower consumers to easily monitor energy usage (i.e., energy-usage patterns, renewable energy production, and the available energy stored in the batteries).

Through circuit-level management, consumers can learn how much energy each appliance consumes and, thus, turn loads off based on usage (i.e. turning off the water heater when the home is unoccupied) or on economics (i.e. turning off high-energy-consuming appliances during peak periods when electricity rates are high).

Consumers can access easy-to-understand environmental data based on their renewable energy production efforts (e.g., your avoided carbon dioxide emissions is equivalent to removing 100 cars from the road for a day). Customers can also view cost-savings information related to their participation in utility-sponsored demand response programs, enabling utilities to turn off non-essential loads to efficiently manage peak demand periods.

Customers can subscribe to e-mail or text-message alerts (e.g., an outage has occurred, you have 10 hours of backup power available), receive comprehensive energy reports on consumption, production and system performance, as well as gain an aggregate view of multiple sites, essential for facility managers with several locations.

Enabling The Smart Grid

In addition to providing consumers with an easy way to incorporate renewable energy and manage their energy usage, GridPoint is a critical enabler of the Smart Grid, allowing electric utilities to efficiently manage peak periods through a distributed, intelligent network of GridPoint appliances. The network enables utilities to control loads, store energy, and produce power.

Utilities can meet the rising demand for power, while eliminating the need to build new peaking power plants, which face regulatory, environmental, and "time-to-build" hurdles. For example, during periods of peak demand for electricity, a single utility that has deployed 5,000 GridPoint appliances across its service territory can draw upon 30 megawatts of stored capacity, equivalent to the amount of electricity generated by a peaking power plant.

The GridPoint appliance within the home or business communicates with the GridPoint Operations Center, which acts as an intelligent hub that processes and exchanges information across the platform and provides software applications for utility and customer control. Utilities gain direct control of the network through the GridPoint Control Console, located in the utility control room. Consumers manage their energy through the online energy-management portal.

For utility customers who have enrolled in a demand-response program, utilities can efficiently manage peak periods by controlling customers' non-essential loads or dispatching power into the grid.

Through GridPoint's advanced intelligence, utilities gain precise control over load-management devices to offer superior demand-response programs. Utilities can measure, control, and verify any number of circuits (e.g., air conditioners, water heaters) either in aggregate or by substation, feeder, or individual customer—enabling utilities to compensate customers based on their actual participation in demand-response programs.

Additionally, utilities increase customer enrollment and satisfaction in demand-response programs by minimizing the impact on customers (i.e., controlling temperature within a few degrees versus completely shutting down air conditioners).

During peak-demand periods, utilities can also dispatch power from the batteries into the grid versus tapping or building less-efficient peaking power plants, thereby reducing carbon emissions and conserving fuel, capital, and land resources. Additionally, utilities can optimize existing highly efficient base-load generation by recharging batteries from the grid during off-peak periods. Furthermore, utilities eliminate the intermittency of renewable energy by extending the capacity produced by renewable energy systems (i.e., storing wind energy in the batteries at night).

Finally, GridPoint Operations Center monitors the performance status of GridPoint appliances to preemptively address maintenance needs, ensuring reliability for consumers and the utility. Conversely, the appliance remotely receives software upgrades and information, such as new utility-pricing schedules from the operations center.

Ultimately, utilities achieve business objectives, increase grid reliability, promote environmental stewardship, and fuel the adoption of residential and commercial renewable energy systems. Consumers gain protection from power outages, increase energy efficiency, and easily integrate solar and wind energy systems. The result is a powerful platform that enables the Smart Grid and aligns the interests of utilities, consumers, and the environment. UHD

The Author

Betsy Cragon is Vice President, Marketing for GridPoint, a clean tech company based in Washington, D.C. She is responsible for corporate branding, marketing communications, market research, and demand creation. Prior to joining GridPoint, she founded Cragon Communications, a public relations firm focused on fueling the growth of technology start-ups as well as repositioning *Fortune 500* technology products to address new markets.

Green With Envy: Green Is The Mark Of A Well-Appointed Home

An Easy Way To Upgrade A Home: Solar Thermal

Christine Puleo

synopsis

- *A solar thermal system is like having an in-house power-generation plant.*
- *Solar thermal systems absorb the sun's rays, producing heat that can be stored and used for hot water supply and space heating—and in the near future, cooling.*
- *Evacuated tube solar collectors have insulating benefits that flat-plate collectors do not, and are set to become the default choice for thermal solar applications worldwide.*
- *In solar thermal systems, water is circulated through a series of thin copper tubes or a heat exchanger pipe; the glass Evacuated tube forms an insulated vacuum.*

Introduction

Increasingly, the well-appointed home is a home that is "green," complete with environmentally friendly features and design and building considerations. With an awareness of green issues and technology on the rise nationwide, those who can afford it are rapidly learning more about how to outfit their homes with the latest environmentally friendly technology, design, and materials.

What makes a home green? Green homes can include solar energy, geothermal systems, rainwater harvesting, or the use of recycled products. These types of homes can also be built by using sustainable building practices, which include considerations on how many resources and how much energy is needed to create the structure. And although energy efficiency is a top consideration for most, some green homeowners design homes for improved indoor air quality, aware that building materials can emit chemicals into the living space.

Thankfully, there are now a variety of green techniques and materials available to discerning homeowners.

"What was once seen as 'out there', or 'fringe' a few years ago, is now seen as something more akin to a badge of honor. It is becoming much more stylish, or in vogue, to have

a green home, and it's almost something that can be used as bragging rights," says Steve Elkin, Director of Marketing, Apricus Solar Americas, which manufactures and markets several solar thermal products.

Elkin began working in energy conservation and alternative energy in the mid 1970s, and he is currently a member of Solar Energy Industries Associations (SEIA) Government Affairs Committee in Washington D.C. "It is now the mark of a well-appointed home, and this will become even more the case in the very near future."

Solar Thermal Basics

Solar thermal is not to be confused with solar photovoltaic (PV) panels. With PV technology, the sun's rays hit photovoltaic cells in the panel, which excites the electrons within layers of the cell, which in turn creates electricity. Solar thermal systems, on the other hand, absorb the sun's rays, producing heat that can be stored and used for hot water supply and space heating, and, in the near future, cooling. Passive solar heating and cooling use no mechanical equipment, and are sometimes referred to as natural conditioning. These technologies provide comfort throughout the year by reducing, or even eliminating, the use of fossil fuels or electricity within the home.

Flat-plate thermal solar collectors, the ones some may remember from the 1970s, have been in use for several decades, but only in relatively small numbers, particularly in Western countries. Evacuated tubes, like those offered by Apricus, have also been in use for more than 20 years, but have been much more expensive than flat plate. However, in recent years there has been a great reduction in manufacturing and material costs. The result is that evacuated tubes are now similar in price to flat plate, but with the insulating benefits of the evacuated tube, they are set to become the default choice for thermal solar applications worldwide.

In solar thermal systems, water is circulated through a series of thin copper tubes or a heat exchanger pipe. The evacuated tube is comprised of two layers of glass, and as the sun's rays pass through the clear outer layer, it is absorbed by the black coating on the inner glass tube. The space between the two layers of glass has been evacuated to form a vacuum, which insulates very well against heat loss, meaning good performance, even in cold weather. The tubes are connected to a manifold across the top of the unit and sit unobtrusively on the roof of homes. There are several types of evacuated tubes in use in the solar industry, and Apricus' collectors use the most common—a thermal twin-glass, vacuum-sealed tube—which has superior reliability, performance, and low manufacturing cost. These glass tubes are very strong and able to withstand hail in excess of a one-inch diameter.

Outfitting A Home With Solar Thermal

Solar thermal has been popular for years in Europe, particularly Germany, and is extremely common in Asia. California is the major market for solar thermal, however, those in the North are realizing that this technology is perfectly suited for even the coldest regions of the U.S. California and Florida hold the number one and two solar spots, but New Jersey, Oregon, New York, Pennsylvania, Connecticut, Washington, and even Minnesota round out the top 15 states that use solar thermal.

"Even in the winter, solar collectors using evacuated tubes can contribute to heating due to the excellent insulation properties. That is the beauty of the evacuated-tube technology, performance all year round," says Elkin.

This home in Connecticut was recently outfitted with Apricus Solar collectors. The 5,000-square-foot Colonial-style home was built in 2000. After surveying the home, Apricus representatives decided to place the collectors on the south side of the home to maximize solar usage. An analysis of the family hot-water usage indicated the need for a 120-gallon storage tank and a total of 40 Apricus' tubes.

A solar thermal system is like having an in-house power-generation plant. The average household uses a great deal of energy each day heating water and space heating in the winter, and solar thermal can reduce hot water bills by 50 to 70 percent, which can equate to 25 to 30 percent of the household's total energy consumption.

"We have opted for the evacuated-tube technology because of the higher efficiencies and ability to passively track the sun throughout the day due to the round tube

shape. Even in January, they will provide about 40 percent of typical family's hot water usage," says Elkin.

Costs for a project, such as the one in the Connecticut home, might run about $10,000 or more for whole-house heating, with government tax rebates available that provide 30 percent of the system cost back (up to $2,000).

"For aesthetics, we try to position it so it works the best with the design of the Colonial house, while still optimizing performance. These are exterior-run products, so retrofits are simple and easy. There are no complex design considerations to ponder, and for this reason the collectors are an easy and hassle-free way for homeowners who want to tip their toe into green homes," says Elkin.

"Solar collectors are now considered an important feature of the home and display the social consciousness of the owners. More affluent homeowners have a preference for independence, to be free of reliance on energy companies. It also gives them a feeling of control. By reducing their carbon footprint and breaking their dependence on fossil fuels, they are less reliant on a utility company for their needs," explains Elkin.

"We all know that carbon dioxide emissions contribute to global warming, an environmental issue, which is now of great concern. In fact, the average household can reduce carbon dioxide emissions by as much as 20 percent by installing an Apricus' solar collector," says Elkin.

Going Green

Green building is becoming increasingly popular in the U.S., and homeowners are willing to shell out extra money to create a green home. According to a survey by Cahners Professional Group and Luxury Home Builder, 89 percent of buyers said they would be willing to pay more to purchase a green home or to retrofit their existing home. This is important because many traditional builders believe that homeowners are not willing to pay, and so these builders often avoid using environmentally sound materials or innovative products. Also, green building products are quickly becoming more available in local markets.

Elkin offers the following when retrofitting your home, or if you are thinking about designing a green home from the ground up:

- Consult with an architect on house designs that use energy and resources efficiently
- Create indoor environments that are sensitive to air quality, lighting, acoustics, and special aesthetics
- Minimize construction and domestic waste during the building process
- Optimize local building materials through reuse and recycling
- Optimize natural land use and developing wetlands

"Just one simple solar thermal installation will have a great impact on the fuel needs of this household," says Elkin. "Think of the impact several initiatives such as these can have on a household, particularly if working with an architect who specializes in green homes." UHD

The Author
Christine Puleo is a New York-based freelance writer who covers the arts and green technology.

Tips For Selection And Installation

A reputable company will include expert installation and consulting. However, you would be wise to familiarize yourself with installation basics so you can be informed about your purchase.

Direction And Angle Of Installation

Both angle and direction of installation affect the efficiency of the solar collector. Naturally, the collector is positioned to receive the maximum amount of sunlight each day and throughout the year. General rule of thumb on placement: If you're in the Northern Hemisphere, the collector should face south. If you're in the Southern Hemisphere, the collector should face north. Also, the angle at which the collector is mounted should roughly correspond to the latitude of your location. For example:

- Melbourne, Australia has a latitude of 37 degrees south—the collector should, therefore, face north at a 37-degree angle.
- Albany, New York has a latitude of 42 degrees north—the collector should, therefore, face south at a 42-degree angle.

Mounting the collector at the exact angle suggested is not critical; staying within 10 degrees either side of the latitude is ideal. If the roof is of a suitable angle and facing the correct direction, a flush mount is usually possible. This is by far the easiest and least-expensive option. If the angle of the roof is not suitable, a mounting frame can usually be provided to achieve the desired installation position.

Considering Seasonal Changes

Although perfect for even those in the U.S. "Snowbelt," the products do require that seasonal changes be taken into consideration, as the solar radiation levels differ greatly, and thus, heat output from the collector varies throughout the year. The water-heating system always has gas or electric backup, and so you are guaranteed hot water in any weather.

Creating An Installation Checklist

Of course, the above factors are not the only ones to consider when approaching an installation. You may want to compile a checklist for each installation to ensure that all factors have been considered. Below are a few common items which may be included, and depending on the specifics of your system design, additional items may need to be added.

1. Be sure the collector faces as close as possible due south and is of the correct size.
2. Ensure that the collector is not significantly shaded throughout the day.
3. Make sure that the frame is secured to a structurally sound roof or wall.
4. Be sure that the pumping pipe runs are well insulated.
5. Make sure that insulation above roof level is protected against sunlight with foil wrap or equivalent.
6. Ensure that the controller is configured correctly.
7. Take care that the pump, controller, and all electrical connections are protected from water ingress.

A qualified installer, who will consider all of these factors when designing and installing the system on your home, should always install collectors. UHD

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PacWind

Shaping The Use Of Wind Power In Residential Architecture And Green Building

Ken Johnson

synopsis

- *PacWind founder, Phil Watkins, has come up with two revolutionary turbine designs that are now changing how the wind industry looks at the use of vertical axis wind turbines (VAWTs) in everyday applications.*
- *The PacWind turbines are powered by rare-earth permanent-magnet axial-flux generators, which output "wild AC."*
- *PacWind generators are created to be maintenance-free for decades, and can continuously run at rated output for 30-plus years.*
- *In several states, including California and New Jersey, there are rebates that allow consumers to recover 70 percent, and many times more, of the purchase-price of an installed PacWind system up to 30 kilowatts.*

Alternative Versus Mainstream

Alternative 1. Employing or following non-traditional or unconventional ideas, methods, etc.; existing outside the establishment.

Energy 1. Any source of usable power, such as fossil fuel or electricity

From the above definitions, we could assume an alternative energy source being any source of usable power, employing non-traditional or unconventional ideas or methods, outside the establishment. But why are some forms of energy deemed alternative and others deemed mainstream?

Well, unfortunately, it comes down to economics. The mainstream methods of meeting our incessant demand for powering our modern day lives has come to be globally accepted as the normal course of doing business, even though it is generally assumed to be in direct conflict with the health and harmony of our earth.

What will it take to bring our alternative energy sources into the mainstream?

Well, this will take worldwide acceptance of alternative energies as our new mainstream protocol, of course, but to achieve this it can only be necessitated through a number of events happening today and in the near future. Of these events, two of the most critical are the advent of new alternative energy technologies that make it economically viable for all of us to choose alternative energies over our current mainstream protocol, and possibly, and more importantly, for the architectural community to seek out and embrace these new technologies and make them an essential part of our homes and buildings.

One of these new technologies is a product line created by PacWind, Inc. located in Torrance, California. PacWind's mission is to make the use of wind energy second nature to all of us in both rural and populated areas of our globe.

PacWind Delta I

Wind Power 101

Wind power, for the most part, has been limited to rural areas where there's been limited resistance to the imposing towers, and accompanying noise of the horizontal axis, or propeller-based, wind turbines (HAWT). But even today, as we awaken to the needs for clean energy production, there is growing resistance to the installation of HAWTs in rural communities, and even more so in, or near, populated areas.

To overcome these inherent hurdles to utilizing wind energy and create a product line that can be brought to the masses in an economical way, back in the late 90s, PacWind turned its attention to a different type of wind turbine—the vertical axis wind turbine (VAWT). VAWTs have been around about as long as HAWTs have been, but VAWTs have never become mainstream in the industry.

Typically, VAWTs have always been very low in power output in relation to their installed cost, while HAWTs have generally made better economic sense; hence, the widespread use of the cumbersome HAWTs.

S. J. Savonius invented the first VAWT back in 1922. His designs are referred to as drag designs that were pushed by the force of the wind. They typically work well in lower wind conditions but have generally been lacking in energy output and never exceed a one-to-one tip speed ratio (blade speed versus wind speed). This is due to the fact that while the wind is propelling the blades on one side of the turbine, the oncoming blades are creating resistance back into the wind. Because of this, the Savonius' decade-old designs have never been able to pack much of a punch when it comes to energy output, thus making them economically unviable in most situations.

In 1931, G. J. M. Darrieus invented a lift-producing version of the VAWT that captured the power of the wind in a much different manner than Savonius' designs did. They were predominately lift designs and had no problem surpassing a one-to-one tip speed ratio. These designs packed quite a punch (too much actually) in moderate to high wind speeds, but they had two major flaws that made it necessary to incorporate separate starting and braking mechanisms in designs that have popped up over the years. While they are great in the fact that they can harness a great deal of the wind's energy, they are severely handicapped, in a similar fashion as HAWTs are, in that they need fairly high winds to start rotating and also cannot self-regulate themselves to prevent mechanical failure from over spinning.

PacWind

Phil Watkins, founder and CEO of PacWind, armed with decades of experience in the wind industry, went back to the drawing board to create turbines that performed admirably in the full range of wind speeds and surpassed a one-to-one tip speed ratio. At the same time, there was no need for either starting or braking mechanisms.

From his drawing board, Mr. Watkins came up with two revolutionary turbine designs that are now changing how the wind industry looks at the use of VAWTs in everyday applications. He designed two proprietary turbine designs that incorporate the characteristics of both the Savonius' and Darrieus' designs of the past. Mr. Watkin's new line of Savarrieus™ turbine designs are quite a breakthrough.

PacWind Seahawk Five-Stack

PacWind Aeolian

Alpha Series

The first line of PacWind Savarrieus turbines, the Alpha Series, lend themselves more toward a drag design rather than lift. They are propelled, or pushed, by the wind, as most all other Savonius-type of VAWTs are, but they also have the unique characteristic of cancelling out the resistance of the oncoming blades rotating back into the wind, thus negating much of the power loss that is experienced by most all other Savonius' designs out there today. The Alpha Series consists of the Seahawk and Aeolian models, both of which incorporate the first new Savarrieus' blade design that Mr. Watkins created. This blade is similar to that of a sail on a sailboat. While it is quite simple in design, it is also extremely effective in operation.

Seahawk

The Seahawk model is projected to be a major contributor to the shaping of the use of wind power in the residential architectural and green building design industries. The Seahawk seems to blend into nearly any environment. When installed it seems to mesmerize all who happen to catch a glimpse of it in motion.

The PacWind designs, including the Seahawk, do not require monstrous towers as conventional HAWTs do. The reason that HAWTs must be mounted on 60- to 150-foot towers is that they require clean, or non-turbulent, air to operate effectively. If a HAWT were to be installed in a location with turbulent air, it would simply try to locate where the wind was coming from by pivoting back and forth without creating any energy, but causing immense wear and tear on the turbine. The Seahawk has no trouble with turbulence whatsoever. It doesn't care what direction the wind is coming from. Should the wind shift direction suddenly, which it generally always does, the Seahawk will maintain a constant power output. There is also no wear and tear on the unit in turbulent or high winds since it is so stable and doesn't need to pivot to find the wind direction. The unit is maintenance-free and should be up and running for many decades after installation.

The Seahawk is being installed for telecommunications sites, and in remote monitoring sites, highways, bridges, boats, lighting and security towers, and commercial/industrial buildings of all shapes and sizes, but the most widespread use of the Seahawk is turning out to be for the residential market. It can be used aesthetically nearly anywhere on a property—even attached to a home, or incorporated into one. The Seahawk is compact (48 inches high x 30 inches deep) and lightweight (140 pounds), and is power rated at 500 watts in a 28-mile-per-hour (mph) wind, with a maximum output of approximately 2.5 kilowatts (kW).

The Seahawk, like the other PacWind designs, can be installed in tower configurations of up to five turbines high, allowing for some intriguing architectural possibilities. These towers come with optional solar on top for added energy production, if requested.

Aeolian

The Aeolian model incorporates the same blade design as the Seahawk and has many of the inherent qualities of the Seahawk, simply on a larger scale. It is being used in residential, commercial, industrial, and agricultural applications of

PacWind Seahawk Security Tower

all sizes. The Aeolian is 60 inches high x 120 inches deep, and weighs approximately 575 pounds. The rated power of the Aeolian is 5 kilowatts in a 28-miles-per-hour wind.

Delta Series

The second line of PacWind Savarrieus' turbines, the Delta Series, consists of four turbines presently—the Delta I (three-, five-, and six-blade versions) and the Delta II. As with the Alpha Series, the Delta Series turbines have characteristics of both the Savonius' and Darrieus' turbine designs of years gone by. The Delta Series lends itself more toward a lift design rather than a drag design.

The unique Savarrieus' blade design of the Delta Series incorporates PacWind's proprietary Inboard and Outboard Vortex Cups™, which have three very unique characteristics:

- They utilize the forces of drag to capture the energy of the wind at very low speeds, allowing the Delta turbines to self-start very easily.
- They utilize the forces of lift to transition to a high-tip speed ratio in moderate winds and sustain that ratio in high winds as well.
- They utilize the forces of drag once again to keep the turbine cage at its maximum rotational speed without over spinning.

This is revolutionary in the VAWT industry and proprietary to the PacWind Savarrieus Delta Series.

In moderate winds, when the Delta turbines transition to a predominately lift mode, the turbine's revolutions-per-minute (rpm), along with their power output, simply skyrocket. The tip speeds of these turbines increase from approximately one-to-one up to approximately four-to-one. This occurs with only a slight increase in wind velocity of one-mile-per-hour. This transition takes place at approximately 12-miles-per-hour wind speed.

As mentioned above, the Inboard and Outboard Vortex Cups also act as the rotational regulators for the Delta Series. The leading edge of the Savarrieus Delta blade creates the proper amount of drag so as to not allow the turbine to overspin, as all other lift designs generally do. This allows PacWind to eliminate the need to install a braking mechanism, which makes the turbine more economical to manufacture and also more economical for the consumer. This also rids the turbine of the many maintenance issues that go along with braking systems, which are prevalent in most designs on the market today.

Delta I's

The Delta I design has three current variations, consisting of the original three-blade model along with the newly released five-blade and six-blade models. The five- and six-blade models are geared a bit better for lower wind conditions due to their increased area of wind-swept area (blade area). All three designs generally have the same power ratings of 2 kilowatts at 28 miles per hour, with a maximum output of approximately 3 kilowatts in winds over 30 miles per hour. The Delta I turbines are compact (48 inches high x 79 inches deep) and lightweight (130 pounds) for the amount of power that they can generate. PacWind also can change turbine diameters at the request of the customer, especially with projects that call for particular dimensions for building integration. Generally, most PacWind designs can vary considerably in height and width, as per customer requests, due the simplicity of scalability inherent to their unique designs, coupled with streamlined manufacturing processes.

The advent of new alternative energy technologies make it economically viable for all of us to choose alternative energies over our current mainstream protocol.

Delta II

The Delta II turbine is currently PacWind's largest model. It has five times the output of the Delta I design and is a bit larger in size and weight (120 inches high x 156 inches deep at 500 pounds). The Delta II three-blade is the only version of this line of turbine currently available, with five- and six-blade variations to be tested late in 2007. The Delta II has a rated output of approximately 10 kilowatts in 28-miles-per-hour winds.

Reliable And Efficient

The PacWind turbines are powered by rare earth permanent magnet axial flux generators. The output of the generator is referred to as "wild AC." This term is used due to the fluctuations in the amount of energy that is produced by wind turbines. This "wild AC" power is typically rectified to DC power in the PacWind generator when used in systems that utilize charge controllers, batteries, or capacitors. The "wild AC" is not rectified in the generator when direct grid tie inverters are utilized in the installation.

The PacWind generators are created to be maintenance-free for decades. They contain no gears or belts and have no moving parts. The generator can continuously run at its rated output for 30-plus years. The generator casing is made of sand-cast aluminum, and all of the internal components to the generator are sealed so as to be extremely resilient in all climactic conditions.

Typically in wind turbine systems, there is considerable energy loss due to extreme voltage ranges and other electronic matters. To avoid this, PacWind works with customized power-conversion units that capture the full range of power output with minimal power loss in all variations of installations to insure that maximum return on investment is always achieved.

The turbine blades and cages are manufactured for nearly indefinite operational life spans. The blades of both the Alpha and Delta Series of turbines are made of protruded fiberglass.

The range of operating temperatures for the turbines is -40 to +160 degrees Fahrenheit. The range of wind speeds that the turbines can operate safely is 0- to 120-miles-per-hour. PacWind hopes to find a wind tunnel that will allow them to test their turbines to destruction, if possible, so as to raise the bar on structural integrity in the wind turbine industry even higher.

Wind Incentives And Rebates

PacWind's goal is to make their product lines attainable to as much of the population as possible, and with the help of our governments on the city, state, and national levels, it is now becoming nearly impossible, in some areas, to say no to the utilization of PacWind turbines for commercial and industrial properties, but especially for residential properties. For example, in several states, including California and New Jersey, there are rebates that allow consumers to recover 70 percent, and many times more, of the purchase price of an installed PacWind system up to 30 kilowatts. There is also federal legislation before the House of Representatives and Senate that will implement up to a 30 percent tax credit of the total cost of small wind turbine installations.

PacWind Projects

Some notable projects that PacWind has installed, is under contract for, or is currently negotiating include:

- Optimum Performance Home™, The Sea Ranch, California, U.S, Green Building Council Leadership In Energy & Environmental Design (LEED®) for Homes Pilot—Seahawk Dual Turbine System
- The Public Utilities Commission Building, San Francisco, California
- Numerous architectural high-rise projects
  - San Francisco, California (2)
  - Louisville, Kentucky
  - Atlanta, Georgia
  - Long Beach, California
  - Boston, Massachusetts
  - Sydney, Australia
- Numerous celebrity installations (partial list):
  - Ed Begley Jr's home, Studio City, California (member of PacWind Board of Directors)
  - Jay Leno's world famous car garage, Burbank, California
  - Mario Van Peebles home, Los Angeles, California
  - Bill Nye, a.k.a.The Science Guy, Studio City, California
  - Marlon Brando Estate, Island of Tetiaroa, Intercontinental Hotels
- United States Geological Survey team, Adak, Arkansas
- United States Navy
- United States Army
- Department of State, U.S. Embassy installations
- California Department of Parks
- Chesapeake Bay historic lighthouse renovation
- Professional soccer stadium, United Kingdom
- Numerous wind farm sites with Delta II tower designs in Hawaii, Texas, North Dakota, United Kingdom, Spain, and New Zealand

Architectural Acceptance

Beyond all of the benefits written about in this article, the true benefit of utilizing these revolutionary turbines from PacWind is the fact that they are so versatile. They can literally be used wherever the wind blows.

PacWind is working with residential, commercial, and landscape architectural firms worldwide. As soon as the education process starts for an architectural firm new to the possibilities of utilizing PacWind turbines into a project, it's almost like watching kids in a candy store. The new ideas start to flow freely amongst the architects, designers, and engineers, and new concepts in building integration and design are created right before our very eyes. There is an incredible amount of excitement in the air, literally, when it is realized that buildings of all shapes and sizes, with power demands ranging from a couple of kilowatts up to several megawatts, can be powered, sometimes entirely, by the power of the wind.

A new technology is upon us, and many new possibilities are now being presented to the architectural community. It is PacWind's hope that their turbines can play a pivotal role in the shaping of this burgeoning industry of earth-friendly design and that the architectural community will continue to embrace the new technologies that PacWind has delivered.

For further information on PacWind products, please visit www.pacwind.net. UHD

The Author

Ken Johnson is a founding member and Chief Operating Officer of PacWind, Inc. His background is sales, marketing, and business development, and he is helping PacWind with structuring its future business model for dealer and installation networks, direct sales, and overseas business expansion. His mission is to brand PacWind products as the most dependable and economical wind turbines available on the market today and into the future.

For more information on this advertiser, circle 18

Pushing The Envelope With The TrendSetter® PiggyBack™ Solar Water Heating System

Norman Ehrlich

Water Heater Replacement

When it's time to replace your water heater, who do you call? A plumber, naturally. This is why TrendSetter® has developed the PiggyBack® Solar Water Heating System—it's plumber friendly and requires little specialty training. TrendSetter believes that its PiggyBack system can be seamlessly introduced into the water-heater-replacement market by plumbers that would not ordinarily consider becoming a solar installer.

Typically when a water heater springs a leak, an emergency ensues. Due to the exigency of the situation, the customer wants to have his hot water restored as soon as possible. The PiggyBack allows the plumber to restore the hot water service to the customer and at the same time install the solar system without major modifications.

PiggyBack is named for the fact that a traditional hot water heater sits on top of this new solar hot water tank and works by circulating solar-heated water into the traditional hot water heater. This new tank has several key advantages over the traditional two-tank residential solar pre-heat systems and will prove to be a highly efficient and more affordable solar hot water solution for most homeowners using traditional water heaters. The new system is not designed to replace the larger more comprehensive TrendSetter systems, such as the combined solar radiant floor and domestic hot water systems; it is designed to fulfill the needs of the more ubiquitous water heater retrofit market and allows the customer to benefit from the current Federal Tax Credit program.

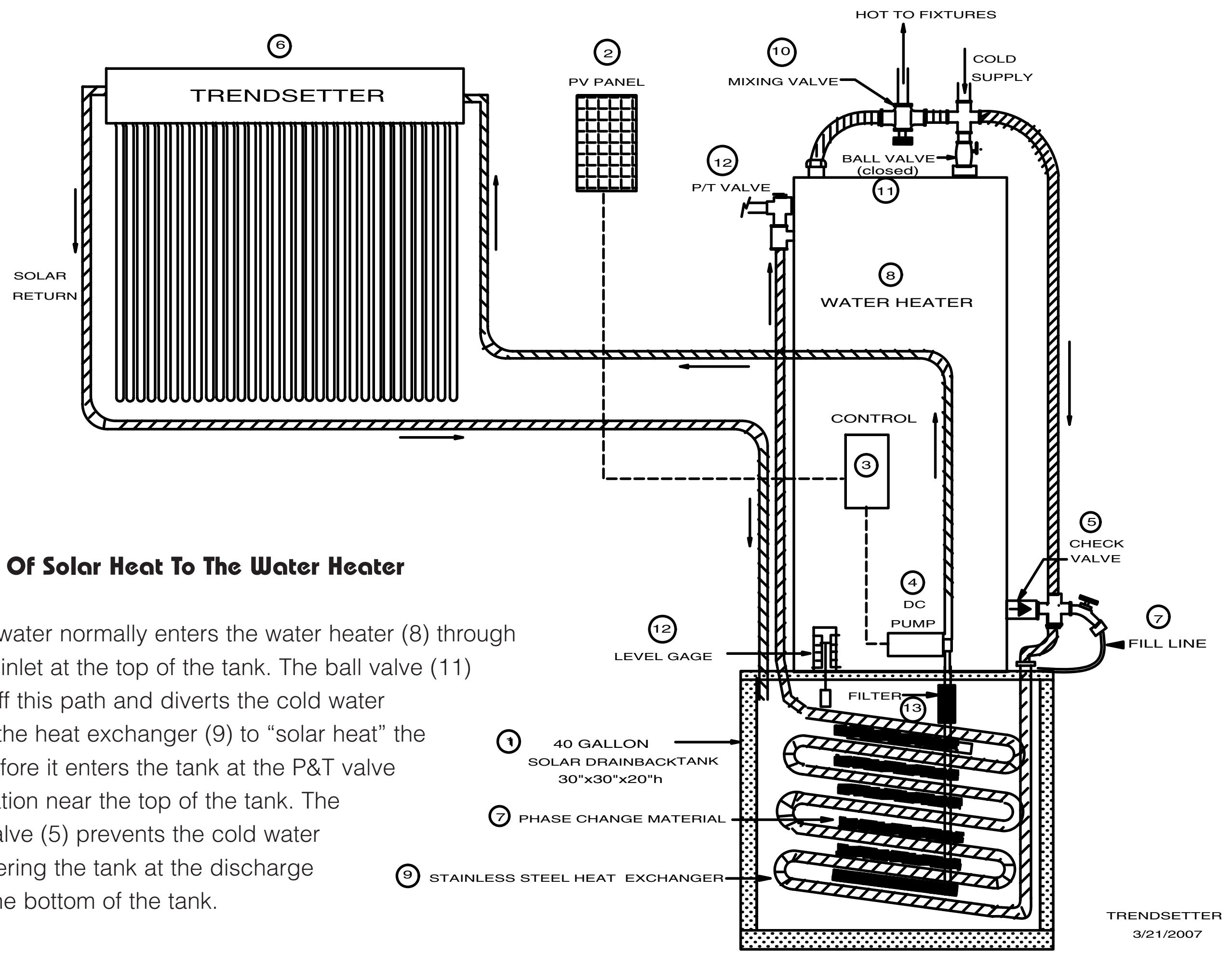
Another advantage is the improvement in technology that allows the system to operate off of a photovoltaic (PV) panel, which is included with the system. The combination of proprietary electronics and a 12-volt solar water pump make the system highly efficient and independent of the homeowner's electrical utility. The simplicity and elegance of the system's engineering and design gives the new product an extended life cycle, with little maintenance, estimated to be in excess of the life cycle of a traditional hot water heater.

TrendSetter is also introducing phase change material (PCM) into its solar storage tanks. The introduction of PCM into the design makes the solar process more of an exact science and improves the performance and longevity of a solar-water heating system. PCM changes from a solid to a liquid by absorbing large amounts of heat energy during this process. A constant temperature is maintained during this process, until all of the material is liquefied. This is called latent heat of fusion. The process is reversible, and when the material is cooled the heat is released at the same temperature as when it melted. The phase change temperature of the material can be selected based on preferred operating temperatures.

How The System Works

Solar Operation

The non-pressurized solar storage tank (1) contains 40 gallons of tap water, initially filled from a garden hose or fill line. The level gauge (12) shows when the tank is filled to the proper level. The tank water does not mix with the potable hot water discharged at the fixtures. When the sun comes up, the PV panel (2) receives sunlight. The controller (3) conditions the voltage and provides power to the dc pump (4) for a soft start and maximizes the power output of the PV panel (2). The water in the tank gradually heats up as water is circulated from the tank through the 5-micron filter (13) to the TrendSetter evacuated tube solar collector (6) and back to the tank. The phase change material (7) will melt as the water in the tank begins to exceed 115 degree Fahrenheit. This process will significantly improve the thermal performance of the system.



Transfer Of Solar Heat To The Water Heater

Cold water normally enters the water heater (8) through the cold inlet at the top of the tank. The ball valve (11) blocks off this path and diverts the cold water through the heat exchanger (9) to "solar heat" the water before it enters the tank at the P&T valve (12) location near the top of the tank. The check valve (5) prevents the cold water from entering the tank at the discharge port at the bottom of the tank.

Natural Thermal Convection

The water heater (8) is also passively thermally coupled through the heat exchanger connections at locations P&T valve (12) and check valve (5). The normal temperature of a water heater (8) is 120 degree Fahrenheit. Normally the temperature at the bottom of a tank-type water heater would be approximately 90 degree Fahrenheit when the top of the tank is 120 degree Fahrenheit. Hot water wants to rise to the top because it is less dense than cold water. We use this principle to transfer the solar energy from the solar-storage tank (1) to the water heater (8) once the temperature in the solar tank exceeds the water temperature at the bottom of the water heater tank.

Why The Thermal Convection System Is Superior To Other Solar Water Pre-Heating Systems With Tank Type Back-ups

Virtually all solar-water heating systems preheat the make-up cold water entering the water heater when hot water is drawn at the fixtures. This happens only during times that hot water is being used. The PiggyBack system:

- Saves space.
- Transfers solar heat 24 hours a day by natural convection.
- Uses no electrical power from the grid.
- Passively optimizes solar storage capacity.
- Provides damping of temperature swings.

Conclusion

As the PiggyBack system is released to the marketplace, it is expected that the reception by the traditional trades will be great. It makes sense that solar hot water systems will become mainstream products and viewed by everyone as a necessary part of home design. As every consumer becomes aware of their carbon footprint and their impact on the planet, the TrendSetter PiggyBack will prove to be a reliable solution. UHD

The Author

Norm Ehrlich founded Six Rivers Solar, Inc. in 1979, and currently serves as Senior Engineer for TrendSetter Industries, Inc., manufacturers of solar hot water systems. In the past 25 years, he has designed and installed all aspects of residential and commercial solar thermal systems, wind energy systems, off- and on-grid photovoltaic systems and sunrooms. He has a strong commitment to alternative energy, ecology, and cost-saving energy efficiency. Norm can be reached at 707 498 2466 or by email at norm@sixriverssolar.com.

Geothermal Systems Save Homeowners Money And Protect The Environment

Ryan Stauffer

synopsis

- *A geothermal system utilizes the Earth as a free-heat source captured by a series of underground polyethylene pipes that circulate a water/anti-freeze solution, called a ground loop, to transfer heat to and from the home.*
- *During the heating cycle, a geothermal system regularly circulates water through its ground loop to extract heat and reverses the process in the cooling mode to extract heat from the house and return it back to the ground.*
- *The efficiency ratings of a geothermal system are up to five times higher than conventional heating and cooling systems.*
- *The system's high-efficiency ratings allow owners to enjoy comfortable heating and cooling, while saving up to 70 percent on their bill, compared to conventional systems.*

With utility costs and carbon emissions on the rise, homeowners are looking for energy-efficient solutions that can save them money and protect the environment. Geothermal manufacturers like WaterFurnace International, Inc. have filled this need with geothermal-heating and geothermal-cooling solutions that are both economical and environmentally friendly.

Many terms are used to define these types of systems. Some sources call it geoexchange, while others call it geothermal, or ground source. In reality, all of these terms are one in the same. Geothermal is the most commonly used term; therefore, it will be utilized throughout this article.

A geothermal system utilizes the Earth as a free-heat source. While outdoor air temperatures fluctuate from season to season, ground temperatures stay consistent all year long. The ground is able to maintain a higher rate of temperature consistency because it absorbs 47 percent of the sun's energy that reaches the Earth's surface. A common misconception of the technology is that geothermal systems use steam and geysers to take advantage of this unique heat source. Actually, these systems utilize a series of underground polyethylene pipes that circulate a water/anti-freeze solution, called a ground loop, to transfer heat to and from the home.

During the heating cycle, a geothermal system regularly circulates water through its ground loop to extract heat. The unit then transfers this heat from the loop to the home in the form of forced air distributed through a conventional duct system, hot water for radiant floors, or domestic hot-water heating.

In the cooling mode, a geothermal system reverses the process to extract heat from the house and return it back to the ground. Once the heat is extracted from the air in the home, it is redistributed as cool-conditioned air. A great example of how this process works is to feel the hot air blowing out of the vent at the bottom of a refrigerator. A refrigerator cools by moving heat from its interior and placing it into the air, in the same way a geothermal system moves heat from a home and places it into the ground via a ground loop.

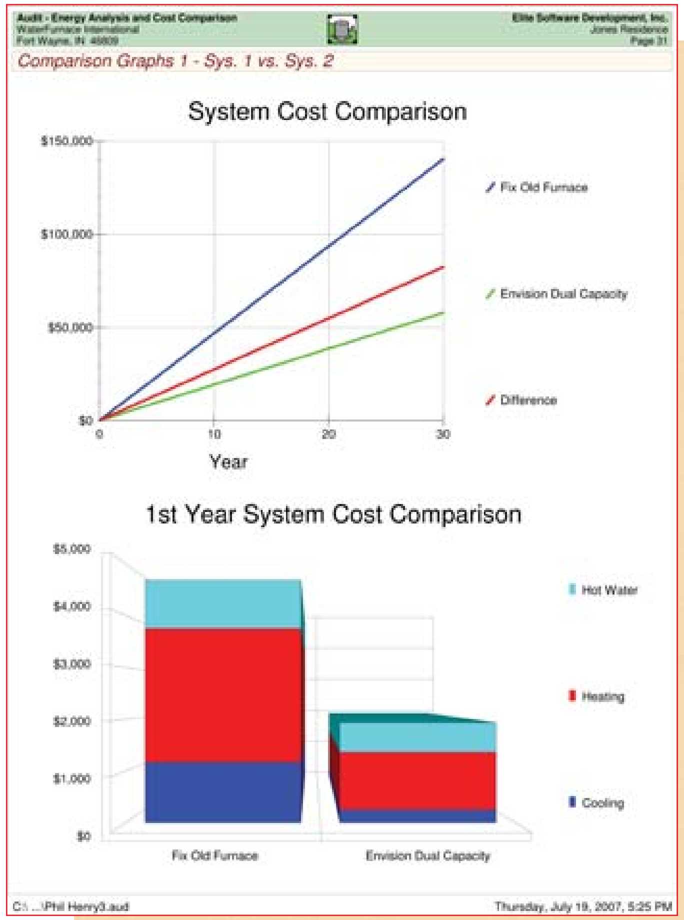
Geothermal systems work well with a variety of different loop applications. The loop types are well water loops (open loops) and ground loops (closed loops). In an open-loop application, water pumped from a well is delivered to the geothermal system for heat to be extracted to and from the water. The leftover water discharges into a drainage field or nearby pond. This application can be the most economical installation type, since there are no excavation and drilling costs required. However, the water in the well must have a low-mineral content to enter the system without causing damage, and the well must have enough capacity to fulfill domestic water needs and supply the geothermal system.

Closed-loop systems are utilized in a variety of applications. For a home with a sizeable lot, horizontal trenching would be the preferred method. The ground loop pipes are placed in a trench at a depth of four to six feet and a length between 100 and 400 feet. Even though this method tends to be the most economical ground loop option, it can significantly damage the homeowner's backyard.

A vertical closed-loop system is often used when the ground consists of dense rock or the lot space is limited. A drilling rig is used to drill 6-inch diameter vertical holes from 150 to 350 feet in depth. The geothermal pipe is placed in the holes and is thoroughly grouted to ensure the loop has good contact with the surrounding earth. Although this installation type tends to be the most costly, it may be the homeowner's only choice when considering soil type and lot space limitations.

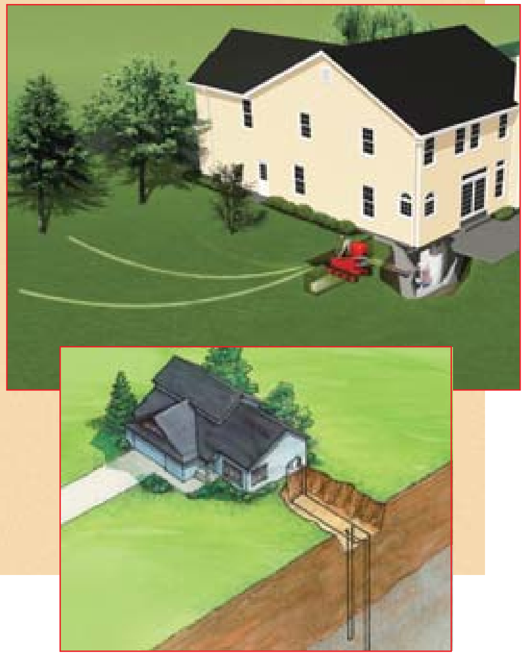
A pond or lake closed-loop system is a great option for homeowners who have a large body of water nearby. Large coils of loop piping are laid on the bottom of the pond or lake to exchange heat from consistent water temperatures. A pond or lake loop can be one of the least expensive installations if the application meets certain guidelines. The body of water should be no further than 150 feet away from the home, and it should be at least 8-feet deep year-round.

Horizontal boring is a closed-loop-drilling technique for geothermal installations in existing homes. A horizontal drilling rig is used to horizontally-bore 6-inch diameter holes 10 to 20 feet below the earth at a length of 100 to 200 feet. This is the least destructive loop type, leaving a homeowner's yard virtually untouched.



Another loop type is utilized by geothermal direct exchange systems. Instead of using durable polyethylene piping filled with a water/anti-freeze solution like conventional geothermal systems, direct-exchange systems use copper piping filled with refrigerant. Many manufacturers have tried this loop type in the past, due to the greater conductivity of copper and the higher efficiencies achieved through the refrigerant directly exchanging heat from the ground. However, most of them have wisely stepped away from this alternate option due to problems with the copper pipe corroding and potentially leaking thousands of pounds of expensive refrigerant.

There are countless benefits enjoyed from the installation of a geothermal system. For example, the efficiency ratings of a geothermal system are up to five times higher than conventional heating and cooling systems. In fact, WaterFurnace International leads the industry with its Envision line that achieves 500 percent efficiency in heating and a 30 EER (Energy Efficiency Rating) in cooling, as rated by the Air-Conditioning and Refrigeration Institute (ARI) 13256-1 (GLHP). These high-efficiency ratings allow geothermal



Horizontal and Vertical Ground Loops

system owners to enjoy comfortable heating and cooling, while saving up to 70 percent on their bills, compared to conventional systems.

Homeowners of new or existing homes can enjoy these savings. The operating cost (see comparison) for a 2,069-square-foot home in Sacramento, California shows that in existing homes, system repair is the most expensive option. Moreover, the economic analysis (see analysis) of a heating and cooling installation in a new home shows that if a builder allows $7,000 for the conventional system, while adding an extra $8,000 for a new geothermal system, the monthly operation savings of the geothermal system will outweigh the additional monthly mortgage cost. Therefore, the homeowners will experience positive cash flow from day one, and their payback starts immediately.

Forbes magazine recently published an article in its June issue titled “Underground Cash” that put an industry expert’s house to the test. Phil Jeffers, founder of Energy Design Systems, a software design and consulting firm for the heating and air-conditioning industry, used his company’s software to calculate the most logical replacement for the old heating and cooling system in his 2,352-square-foot home in Exton, Pennsylvania. The systems used for the economic analysis were a conventional heating system and a geothermal system. The initial cost of the geothermal system was $5,200 more than the conventional system.

The results of the economic analysis showed that Jeffers’ current system’s operating costs were running about $371 a month for heating, cooling, and hot water. With a new conventional system, his operating costs would drop to $172 a month, and with a new geothermal system, his costs would plummet to $83 a month. This means that a geothermal system would cost $89 a month less to operate than a new conventional system. Compounded annually, Mr. Jeffers would save $1,068 a year by installing a geothermal system. The difference in initial investment would be made up in a little over four years, and then an $89 positive cash flow would be enjoyed from that point forward. With a return on investment of approximately 21 percent a year, a geothermal system would be a smart investment.

WaterFurnace International and Bee Creek Development in Ossian, Indiana will be working together to create The Bridges, the largest 100 percent geothermal housing subdivision in Northern Indiana. “This project will be a valuable demonstration of what our premium products can accomplish for a complete subdivision,” said Phil Albertson, WaterFurnace Vice President of Sales and Marketing. This 170-lot subdivision will provide the ultimate in “green” living with ENERGY STAR® built villas and homes and a premium WaterFurnace geothermal system installed in every residence.

Collier’s Heating & Cooling, an Ossian-based company with more than 20 years experience installing WaterFurnace geothermal heating and cooling systems, has been selected by Bee Creek Development to provide geothermal heating and cooling for all residences in The Bridges subdivision. They will utilize the three lakes in the development for geothermal lake loops for a portion of the homes, and horizontal closed-loop trenches for the remainder of the lots. “Collier’s is excited to offer homeowners the best heating and cooling systems on the market,” said Todd Zeplin, co-owner of Collier’s. “We know this project will provide further opportunities for our company when homeowners realize how much they've saved by using this innovative ‘green’ technology.”

Along with impressive energy savings, a geothermal system offers homeowners added comfort and improved indoor air quality. Many geothermal systems offer two-speed compressors that allow the unit to run longer, more efficiently, and provide greater comfort. With longer, more consistent run times, a geothermal system is able to dehumidify, filter harmful toxins out of the air, and eliminate cool spots. Most importantly, a geothermal system offers warmer air than a traditional heat pump, and does not waste energy and reduce comfort during the defrost cycle of an outdoor air coil.

For further improvements to indoor air quality, WaterFurnace International offers its own Alpine Pure line of indoor air quality products. WaterFurnace Alpine Pure products include heat-recovery ventilators (HRV) for fresh air exchange and HEPA filtration systems to make a homeowner's air “hospital clean.” Furthermore, WaterFurnace Envision systems come standard with a Merv 11 filter, offering improved filtration capability over the Merv 4 filters that come with conventional systems.

ENERGY efficiency

Another important benefit of a geothermal system is that it is the quietest heating and cooling system homeowners can buy. A geothermal system sits indoors, ridding homeowners of their noisy and unsightly outdoor unit. WaterFurnace systems utilize ultra-quiet Copeland scroll compressors, extra insulation buffers, and acoustic metals to provide homeowners with the quietest heating and cooling system on the planet.

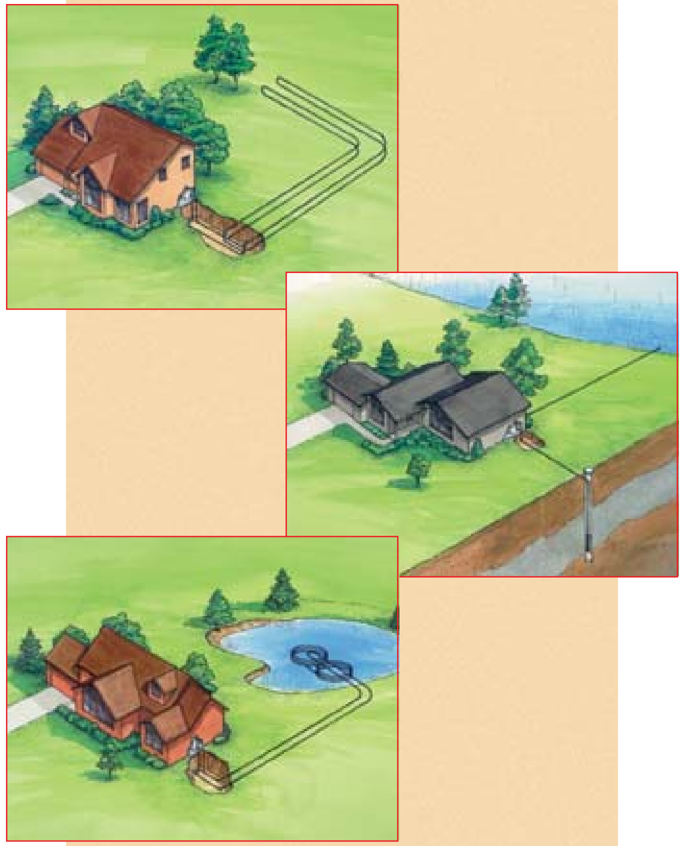
Geothermal systems also offer homeowners increased longevity and piece of mind. While a conventional heat pump or gas furnace might have an average life span of ten years, a geothermal unit lasts 20 years or more, and the ground loop could last a lifetime. WaterFurnace International takes some extra steps in the construction of its units to ensure they outperform and out last any of its competitors. For example, WaterFurnace coats the air coils in its units with its patented FormiShield™ coating that provides superior protection against formicary corrosion that can eat through the coil. WaterFurnace also provides homeowners with added peace of mind by backing the quality of its products with a ten-year standard parts and labor allowance warranty—the most extensive warranty in the industry.

Geothermal systems are great for the environment, because they burn no fossil fuels while operating. The EPA (Environmental Protection Agency) stated that installing a geothermal system in a typical home is equal to planting an acre of trees, or taking two cars off the road in greenhouse gas reduction. The average geothermal system reduces carbon emissions by over 50 tons during its operational life span. In addition, current geothermal installations save more than 14 million barrels of crude oil per year. If one in 12 California homes installed a geothermal system, the energy saved would equal the output of nine new power plants.

Due to its positive impact in reducing energy demand for power plants, federal and state tax incentives are either available, or are becoming available, for geothermal system installations.

The Energy Policy Act of 2005 has made available many tax credits for various home improvements. The details for the federal tax credits available for geothermal systems are located on the ENERGY STAR® Web site at www.energystar.gov/index.cfm?c=products.pr_tax_credits. ENERGY STAR is a joint program of the U.S. Environmental Protection Agency and the U.S. Department of Energy that was formed with the sole purpose of protecting the environment through energy-efficient projects and practices. The tax credits addressed on this site are for homeowners, home builders, and commercial building owners possessing claims within the time frame of January 1, 2006 to December 31, 2008.

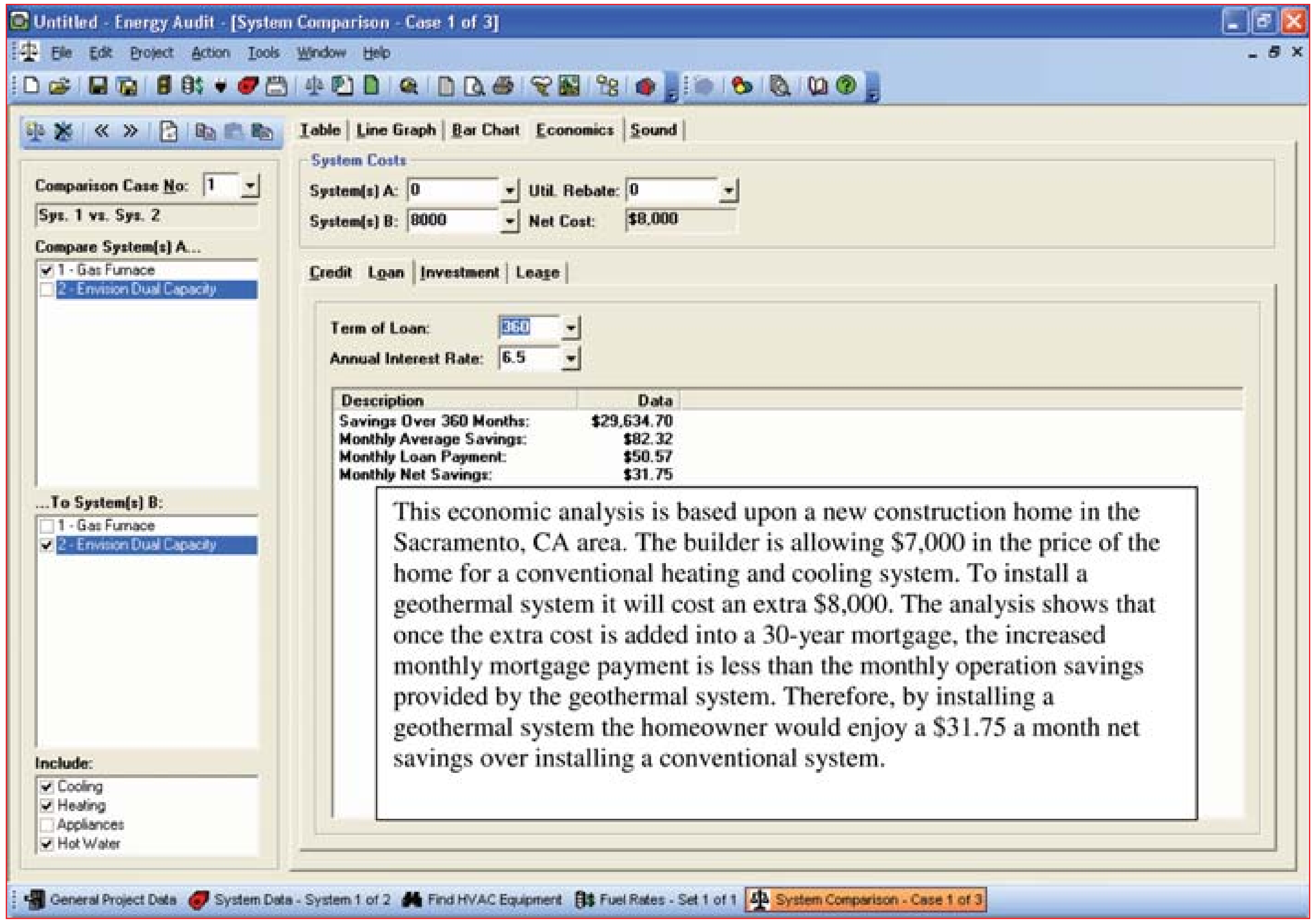
In order for a homeowner to receive a tax credit for installing a geothermal system, a few requirements must be met. The system must include a desuperheater connection for hot water assist, and meet the required heating and cooling performance ratings of greater than or equal to 14.1 EER (Energy Efficiency Ratio) and 3.3 COP (Coefficient of Performance) for a closed loop, 16.2 EER and 3.6 COP for an open loop, and 15 EER and 3.5 COP for a direct-expansion system.



Three Types Of Ground Loops

Additional requirements include a receipt of purchase and a Manufacturer's Certification Statement of the product’s performance ratings. These certificates can be found in the ARI Directory of Product Performance. A link to this site is located on WaterFurnace’s Web site at www.waterfurnace.com under the “Your Home” page. If the geothermal system installed meets all of these guidelines, the homeowner is eligible for a tax credit of up to $300.

Home builders and contractors who install geothermal equipment in the homes they build have a better chance of qualifying for a federal tax credit. Builders are eligible for a $2,000 tax credit for energy-efficient homes achieving a 50 percent higher energy savings than the 2004 International Energy Conservation Code (IECC) and supplements, and contractors are eligible for a $1,000 credit for manufactured homes achieving an over 30 percent higher energy savings than the 2004 IECC and, or EPA requirements under the ENERGY STAR program. In addition, regular energy-efficient



homes are required to have 20 percent of the energy savings come from the building envelope, and 30 percent is required for manufactured homes. In order for these credits to apply, the home must be built in the U.S. after August 8, 2005 and used as a residence within the time frame of January 1, 2006 through December 31, 2008.

Tax deductions are also available for owners and designers of commercial buildings. Existing commercial buildings that achieve a savings of at least 50 percent on their heating and cooling energy compared to ASHRAE Standards 90.1-2001 may be eligible for a tax deduction for up to $1.80 per square foot. A smaller deduction of $.60 per square foot may also be available for improvements affecting the building envelope, lighting, or heating and cooling systems.

WaterFurnace International uses the latest in "green" technology to provide the highest performance ratings in the industry, easily qualifying homeowners, builders, and commercial building owners for all of the state, county, and federal tax credits available across the nation.

Known in the investment community as a "green" investment, WaterFurnace supports local "green" committees and discloses a list of environmental practices that it has in place throughout the organization to all of its current and potential investors.

WaterFurnace hosts the Northeast Indiana Green Build Coalition's monthly meetings at its Fort Wayne, Indiana facilities for their monthly meetings to discuss upcoming events and issues that affect Northeast Indiana. The Northeast Indiana Green Build Coalition has organized events to support the "Step It Up Congress—Cut Carbon Emissions 80 Percent By 2050" effort. They have solicited the help of groups all over the U.S. for their attendance in over 1,000 separate events that will be documented (digital photographs and sign-in sheets) and sent to Congress.

WaterFurnace is engaged in the business of building and promoting the most environmentally friendly heating and cooling system available in the world today. WaterFurnace's engineering department tests each new component to determine if it exceeds the current standards. Each improved product's performance reduces green house gas emissions or CO2 from power plants. In addition, all major components in WaterFurnace products have a component of recycled materials, and the company makes every effort to use components manufactured from recycled materials.

WaterFurnace International

As the leader of the geothermal industry, WaterFurnace International has taken a proactive approach to adhering to the R-22 refrigerant phase out specified in the Montreal Protocol. The Montreal Protocol was signed by the United States to help reduce and prohibit the use of substances that deplete the ozone layer. The U.S. Congress passed the Clean Air Act of 1990 to help implement this agreement. In compliance with this protocol, WaterFurnace has manufactured units with environmentally friendly R-410A refrigerant since 2002. WaterFurnace began this process by including R-410A on its higher-quality product offerings and is now in the process of eliminating its dependence on R-22 refrigerant for all of its products.

The company has established an enterprise-wide program to "Cut Out Waste" (COW). It holds quarterly meetings to reward employees for ideas that have been implemented that Cut Out Waste. To date, the company has implemented more than 200 ideas.

> "The EPA stated that installing a geothermal system in a typical home is equal to planting an acre of trees, or taking two cars off the road in greenhouse gas reduction."

WaterFurnace helps its employees install geothermal heating and cooling units in their own homes. The program so far has reduced carbon consumption by 33 metric tons per year, or the environmental impact of taking 100 cars off the road permanently. WaterFurnace also utilizes 200 tons of geothermal heating and cooling equipment to heat, cool, and provide hot water for the office and manufacturing facility, reducing carbon emissions by 70 metric tons per year, or the environmental equivalent of taking 140 cars off the road permanently.

The company also makes a conscious effort to recycle and purchase recycled materials. A paperless initiative is currently in place in which electronic documents are the preferred method of information transfers and storage. WaterFurnace also recycles paper, bottles and pop cans, batteries, cardboard boxes, wood pallets, refrigerant from old units, scrap metal, etc. Not only are these practices great for the environment, but they make economic sense as well.

WaterFurnace International is an environmentally responsible company whose geothermal products are the best solution for homeowners looking to save money, gain comfort, and protect the environment. These systems utilize the free energy from the ground to save up to 70 percent on heating, cooling, and hot-water costs. By not using fossil fuels to condition a home, a WaterFurnace geothermal system can help homeowners reduce their carbon footprint and assist power plants in reducing overall energy demand. With added comfort, whisper-quiet operation, improved indoor air quality, and increased longevity, a WaterFurnace geothermal system is a smart investment.

To find out more information about WaterFurnace geothermal products, contact a local dealer, or visit www.waterfurnace.com. To learn about tax credits and rebates for geothermal installations, visit www.energytaxincentives.org for federal information and www.geoexchange.org for information by state. UHD

The Author

Ryan Stauffer is Marketing Project Manager at WaterFurnace International. He has worked for WaterFurnace for nearly two years and has experience in both sales and marketing. He has earned a BS in Marketing and Management from Indiana University and is beginning his graduate studies. For more information, visit www.waterfurnace.com.

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